



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

THE FRANCIS A. COUNTWAY LIBRARY OF MEDICINE
HARVARD MEDICAL LIBRARY-BOSTON MEDICAL LIBRARY

ARCHIVES OF NEUROLOGY AND PSYCHIATRY

EDITORIAL BOARD

HUGH T. PATRICK, Chicago
 PEARCE BAILEY, New York AUGUST WIOCH, Montecito, Calif.
 E. E. SOUTHARD, Boston FREDERICK TILNEY, New York
 T. H. WEISENBURG, Philadelphia

VOLUME I
 1919

PUBLISHERS
 AMERICAN MEDICAL ASSOCIATION
 CHICAGO, ILL.

41
Ar 15-12
1551

CONTENTS OF VOLUME 1

JANUARY, 1919. NUMBER 1

	PAGE
THE MILITARY HISTORY OF THE AMERICAN NEUROLOGICAL ASSOCIATION. PRESIDENTIAL ADDRESS. THEODORE H. WEISENBURG, M.D., PHILADELPHIA.	1
THE TREATMENT OF WAR NEUROSES. SIR JAMES PURVES STEWART, M.D., F.R.C.P., LONDON.....	14
WAR NEUROSES: SOME VIEWS ON DIAGNOSIS AND TREATMENT. COLIN K. RUSSEL, M.B., MONTREAL, CANADA.....	25
THE HISTOGENESIS OF MULTIPLE SCLEROSIS. THEOPHIL KLINGMAN, M.D., ANN ARBOR, MICH.....	39
SO-CALLED SHELL SHOCK: THE REMEDY. FRANCIS X. DERCUM, M.D., PHILADELPHIA	65
COMPLETE DIVISION OF THE SPINAL CORD IN LOWER DORSAL REGION. A CASE WITH CONSERVATION OF SPINAL REFLEXES BELOW LEVEL OF LESION. W. F. SCHALLER, M.D., SAN FRANCISCO.....	77
NEUROPSYCHIATRY IN RECRUITING AND CANTONMENT. M. S. GREGORY, M.D., NEW YORK.....	89
THE GENERA IN CERTAIN GREAT GROUPS OR ORDERS OF MENTAL DISEASE. E. E. SOUTHARD, M.D., BOSTON.....	95
EDITORIAL ANNOUNCEMENT.....	113
OBITUARY. MAJOR ALFRED REGINALD ALLEN, PHILADELPHIA. BY CHARLES K. MILLS, M.D., PHILADELPHIA.....	115
ABSTRACTS FROM CURRENT LITERATURE.....	124
SOCIETY TRANSACTIONS.....	130
BOOK REVIEW.....	143

FEBRUARY, 1919. NUMBER 2

A CASE OF OCCLUSION OF THE POSTERIOR INFERIOR CEREBELLAR ARTERY WITH CARDIAC MANIFESTATIONS AND INVOLVEMENT OF THE LEFT VAGUS NUCLEUS. LOUIS HAUSMAN, M.D., NEW YORK.....	145
THE EYE AND AVIATION. WILLIAM H. WILMER, M.D., MINEOLA, L. I., N. Y.	162
THE EAR AND AVIATION. EUGENE R. LEWIS, M.D., MINEOLA, L. I., N. Y....	167
ON THE FOCALITY OF MICROSCOPIC BRAIN LESIONS FOUND IN DEMENTIA PRAECOX. E. E. SOUTHARD, M.D., BOSTON.....	172
THE HISTOGENESIS OF MULTIPLE SCLEROSIS. THEOPHIL KLINGMAN, M.D., ANN ARBOR MICH.....	193
THE SUBACUTE FORM OF MULTIPLE SCLEROSIS. WILLIAM G. SPILLER, M.D., PHILADELPHIA	219
UNSUSPECTED INVOLVEMENT OF THE CENTRAL NERVOUS SYSTEM IN SYPHILIS. P. FILDES, M.B., R. J. B. PARNELL, L.R.C.P., AND H. B. MAITLAND, M.B., HASLAR, ENGLAND.....	231
ABSTRACTS FROM CURRENT LITERATURE.....	246
SOCIETY TRANSACTIONS.....	262
BOOK REVIEWS.....	271

MARCH, 1919. NUMBER 3

ON THE INTRAVENOUS, NOT THE INTRASPINAL, USE OF ARSPHENAMIN IN SYPHILIS OF THE NERVOUS SYSTEM. B. SACHS, M.D., NEW YORK....	277
HISTOLOGIC EVIDENCE OF THE PATH OF INVASION OF THE BRAIN IN GENERAL PARESIS. S. T. ORTON, M.D., PHILADELPHIA.....	285
THE ASSOCIATED INCIDENCE OF SYPHILIS OF THE CENTRAL NERVOUS SYSTEM AND CARDIOVASCULAR SYPHILIS. E. D. FRIEDMAN, M.D., NEW YORK..	289
SYSTEMATIC STUDY OF THE PERSONALITY IN ESTIMATING ADAPTABILITY. G. S. AMSDEN, M.D., WHITE PLAINS, N. Y.....	301
TREATMENT OF DEMENTIA PRAECOX BY INTRAVENOUS INJECTIONS OF SODIUM CHLORID. W. C. MILLER, M.D., WARREN, PA.....	313

CONTENTS OF VOLUME 1

MARCH—Continued

	PAGE
THE BEARING OF WAR NEUROSES ON IMMIGRATION. LAWRENCE KOLB, M.D., ELLIS ISLAND, N. Y.....	317
OBITUARY. JAMES JACKSON PUTNAM, M.D., BOSTON.....	333
ABSTRACTS FROM CURRENT LITERATURE.....	334
SOCIETY TRANSACTIONS.....	354
BOOK REVIEWS.....	380

APRIL, 1919. NUMBER 4

DISTURBANCES OF SPATIAL ORIENTATION AND VISUAL ATTENTION WITH LOSS OF STEREOSCOPIC VISION. GORDON HOLMES, M.D., LONDON, ENGLAND, AND GILBERT HORRAX, M.D., BOSTON.....	385
A PROBABLE ETIOLOGIC FACTOR IN MULTIPLE SCLEROSIS. MALCOLM S. WOODBURY, M.D., CLIFTON SPRINGS, N. Y.....	408
A CLINICAL STUDY OF PSYCHOSES CHARACTERIZED BY DISTRESSED PERPLEXITY. AUGUST HOCH, M.D., MONTECITO, CALIF., AND GEORGE H. KIRBY, M.D., NEW YORK.....	415
PERSONALITY TESTS INVOLVING THE PRINCIPLE OF MULTIPLE CHOICE. ABRAHAM MYERSON, M.D., BOSTON.....	459
SPINAL CORD INJURIES IN WARFARE: SYMPTOMATOLOGY AND DIAGNOSIS. A CRITICAL REVIEW. WALTER F. SCHALLER, M.D., SAN FRANCISCO....	471
ABSTRACTS FROM CURRENT LITERATURE.....	502
SOCIETY TRANSACTIONS.....	517

MAY, 1919. NUMBER 5

A MICROSCOPIC STUDY OF FAT IN THE CEREBRAL CORTEX. OSCAR J. RAEDER, M.D., BOSTON.....	525
A PSYCHOLOGIC STUDY OF STEALING IN JUVENILE DELINQUENCY. L. PIERCE CLARK, M.D., NEW YORK.....	535
PERIPHERAL NERVE INJURIES. GEORGE E. PRICE, M.D., HENRY O. FEISS, M.D., WILLIAM B. TERHUNE, M.D., U. S. ARMY.....	547
AN UNUSUAL CASE OF VAGOTONIA. ALFRED C. REED, M.D., SAN FRANCISCO	560
CONTRACTURE OCCURRING IN PARTIAL RECOVERY FROM PARALYSIS OF THE FACIAL NERVE AND OTHER NERVES. WILLIAM G. SPILLER, M.D., PHILADELPHIA	564
CEREBELLO-BULBAR POLIOENCEPHALITIS ORIGINATING DURING OR AFTER EPI- DEMICS OF INFLUENZA AND OF POLIOMYELITIS. CHARLES K. MILLS, M.D., AND GEORGE WILSON, M.D., PHILADELPHIA.....	567
THE WAR NEUROSES AS PHYSIOLOGIC CONSERVATIONS. SIDNEY I. SCHWAB, M.D., ST. LOUIS.....	579
ABSTRACTS FROM CURRENT LITERATURE.....	636
SOCIETY TRANSACTIONS.....	650

JUNE, 1919. NUMBER 6

PATHOLOGY OF EXPERIMENTAL TRAUMATIC ABSCESS OF THE BRAIN. CHARLES R. ESSICK, M.D., READING, PA.....	673
HISTOPATHOLOGY OF CARCINOMA OF THE CEREBRAL MENINGES. G. B. HASSIN, M.D., CHICAGO	705
A CASE OF MONGOLISM IN ONE OF TWINS. HAROLD SWANBERG, M.D., AND H. A. HAYNES, M.D., LAPEER, MICH.....	717
EUNUCHOIDISM. HYMAN CLIMENKO, M.D., AND ISRAEL STRAUSS, M.D., NEW YORK	726
THE PATHOGENESIS OF TABES DORSALIS. WALTER F. SCHALLER, M.D., SAN FRANCISCO	749
SOME ADVANCES IN THE SURGICAL TREATMENT OF INJURIES OF THE NERVOUS SYSTEM. A CRITICAL REVIEW. CHARLES A. ELSBERG, M.D., NEW YORK	768
ABSTRACTS FROM CURRENT LITERATURE.....	778
SOCIETY TRANSACTIONS.....	792
BOOK REVIEW.....	804

INDEX TO VOLUME 1

The abbreviation "ab" following the page number indicates that the article appears either in Society Transactions or in the Current Literature Department. Book Reviews, Obituaries and Society Transactions are indexed under these headings in their alphabetical order under the letters B, O and S, respectively.

	PAGE
Abrahamson, I.: Neurologic complications of influenza.....	518-ab
Prevalence of infectious lethargic encephalitis.....	663-ab
Abscess, pathology of experimental traumatic abscess of brain; Charles R. Essick.....	673
Acrodystonia ("Akrodystonie" als Folgezustand von Kriegsverletzungen der obern Extremitäten); Robert Bing.....	637-ab
Adaptability, systematic study of personality in estimating; G. S. Amsden	301
Adolescence, psychosis of, pituitary disturbance in its relation to; Beverley Tucker.....	503-ab
Adrian, E. D.: Conduction in peripheral nerve and in central nervous system	253-ab
Alford, L. B.: Irrigation of subarachnoid space.....	503-ab
Some experiments bearing on flow of lymph in nerves.....	260-ab
American Neurological Association, military history of; Theodore H. Weisenburg	1
neurology, opportunity of; Frederick Tilney.....	657-ab
Amnesia as defense mechanism for desertion; D. K. Henderson.....	257-ab
Amsden, G. S.: Systematic study of personality in estimating adaptability	301
Aneurysm, intracranial infiltrating aneurysm as the base, case of; S. Philip Goodhart	373-ab
Aphonia, hysterical, in soldiers with reference to gassing; A. Wilson Gill	648-ab
Archambault, La Salle: Parenchymatous atrophy of cerebellum.....	134-ab
Areflexia, asteriognosis and other sensory defects of abiotrophic origin, case of; J. L. Joughin.....	517-ab
Arsphenamin, intravenous, not intraspinal use of arsphenamin in syphilis of nervous system; B. Sachs.....	277
Arterial tension in mental disease; Claes Enebuske.....	665-ab
Asteriognosis, areflexia and other sensory defects of abiotrophic origin; J. L. Joughin.....	517-ab
Asthenia, neurocirculatory (Effort syndrome); Alfred E. Cohn.....	351-ab
Aviation and the ear; Eugene R. Lewis.....	167
and the eye; William H. Wilmer.....	162
ear in stunt flying; Lewis Fisher and Harry Lyman.....	254-ab
Babinski reflex (Zur diagnostischen Bewertung der Varietäten des Babinski'schen Reflexes); Robert Bing.....	781-ab
Bassoe, Peter: Report of neuroses in soldiers with presentation of cases So-called lethargic encephalitis.....	368-ab
Beers, Clifford W.: Ten years of work of National Committee for Mental Hygiene and some plans for its future development.....	376-ab
Bevor's sign, transverse myelitis showing; George W. Hall.....	364-ab
Belting, C. C.: Case of successful removal of tumor of spinal cord.....	655-ab
Bing, Robert: "Akrodystonie" als Folgezustand von Kriegsverletzungen der obern Extremitäten.....	637-ab
Zur diagnostischen Bewertung der Varietäten des Babinski'schen Reflexes	781-ab

INDEX TO VOLUME 1

	PAGE
Bladder, automatic bladder, excessive sweating and some other reflex conditions in gross injuries of spinal cord; Henry Head and George Riddoch.....	343-ab
Bleuler, E.: Psychologic point of view in psychiatry.....	128-ab
Blood, chlorin content of; treatment of dementia praecox by intravenous injections of sodium chlorid together with studies of chlorin content of blood; William C. Miller.....	313
Book Reviews:	
A Review of Nerve Injuries and Their Treatment; James Purves Stewart and Arthur Evans.....	804
Commotions et Emotions de Guerre; André Léri.....	273
Les Blessures de la Moelle et de la Queue de Cheval; Gustave Roussy.....	143
Neuropsychiatry and the War: A Bibliography with Abstracts; Mabel Webster Brown and Frankwood E. Williams.....	383
Seale Hayne Neurological Studies; Edited by Arthur F. Hurst.....	383
The Psychoneuroses of the War; G. Roussy.....	271
War Neuroses; John T. MacCurdy.....	380
Brachial plexus, lesion of; S. Krumholz.....	362-ab
palsy, traumatic, operation, marked improvement; F. X. Dercum.....	793-ab
Brain abscess, experimental, traumatic, pathology of; Charles R. Essick.....	673
carcinoma of cerebral membranes, histopathology of; George B. Hassin.....	802-ab
comparative studies on growth of cerebral cortex; Naoki Sugita.....	789-ab
disturbances of vision by cerebral lesions; Gordon Holmes.....	783-ab
estimation of proportions of gray and white matter in human brain, made through plane of optic chiasm by means of planimeter; A. E. Taft.....	346-ab
focality of microscopic brain lesions found in dementia praecox; E. E. Southard.....	172
glioma of, trauma and its relation to development of; Israel Strauss.....	138-ab
histologic evidence of path of invasion of brain in general paresis; Samuel T. Orton.....	285
microscopic study of fat in cerebral cortex; Oscar J. Raeder.....	525
tumor with exact roentgen-ray localization; J. Hendrie Lloyd.....	797-ab
tumors in psychopathic subjects; S. L. Immerman.....	653-ab
wounds, treatment of secondary and late complications of; Gordon Holmes.....	788-ab
Brendel, Frank P.: Report of goiter among draft men from the northwest.....	638-ab
Brown, William: Treatment of cases of shell shock in an advanced neurological center.....	342-ab
Brush, Nathaniel H.: Treatment of general paresis.....	250-ab
Byrne, Joseph: Mechanism of pain from physiological standpoint.....	521-ab
Campbell, C. Macfie: Case of childhood conflicts with prominent reference to urinary system; with general considerations on urinary symptoms in psychoneuroses and psychoses.....	256-ab
Camptocormia, general considerations on; Saloff Rosanoff.....	641-ab
Carcinoma of cerebral meninges, histopathology of; G. B. Hassin.....	705, 802-ab
Cardiovascular syphilis, associated incidence of syphilis of central nervous system and cardiovascular syphilis; E. D. Friedman.....	289
Carpenter, F. W.: Nerve endings of sensory type in muscular coat of stomach and intestines.....	352-ab
Catatonia, clinical aspects of "late catatonia" with report of cases; Edward A. Strecker.....	780-ab
Cerebellar artery, case of occlusion of posterior inferior artery with cardiac manifestations and involvement of left vagus nucleus; Louis Hausman.....	145
gait: a pedographic study; I. Leon Meyers.....	645-ab
Cerebellum, parenchymatous atrophy of; La Salle Archambault.....	134-ab
tumor, probable; George W. Hall.....	363-ab

INDEX TO VOLUME 1

	PAGE
Chlorin content of blood; treatment of dementia praecox by intravenous injections of sodium chlorid together with studies of chlorin content of blood; William C. Miller.....	313
Choice, multiple, personality tests involving principle of; Abraham Myerson	459
Clark, L. Pierce: Psychologic study of stealing in juvenile delinquency	535
Clark, Samuel N.: Case with symptoms of Dercum's disease and hysterical manifestations.....	802-ab
Climenko, Hyman: Eunuchoidism.....	726
Cohn, Alfred E.: The effort syndrome.....	351-ab
Conduction in peripheral nerve and in central nervous system; E. D. Adrian	253-ab
Conjunctivitis, hysterical ocular symptoms complicating; A. F. Hurst and C. H. Ripman.....	648-ab
Contracture ("Akrodystonie" als Folgezustand von Kriegsverletzungen der obern Extremitäten); Robert Bing.....	637-ab
occurring in partial recovery from paralysis of facial nerve and other nerves; William G. Spiller.....	564
Coriat, Isador H.: Treatment of dementia praecox by psychoanalysis	643-ab
Cysticercus racemosus (taenia solium) of spinal cord, operation, surgical recovery and death; P. C. Knapp.....	357-ab
Deafness, case of nerve syphilis with acute involvement of auditory nerves and complete deafness; James Hendrie Lloyd.....	651-ab
Deficiency disease, pathogenesis of; Robert McCarrison.....	506-ab
Delinquency, juvenile, psychologic study of stealing in; L. Pierce Clark	535
Delusions, clinical study of origin, development and disappearance of system of delusions; L. E. Emerson.....	260-ab
Dementia praecox, focality of microscopic brain lesions found in; E. E. Southard	172
non-dementia non-praecox; note on advantages to mental hygiene of extirpating a term; E. E. Southard.....	667-ab
treatment by intravenous injections of sodium chlorid together with studies of chlorin content of blood; William C. Miller.....	313
treatment by psychoanalysis; Isador H. Coriat.....	643-ab
Dercum, Francis X.: Hysteria with multiple operations.....	266-ab
So-called "shell-shock".....	65
Traumatic brachial plexus palsy, operation, marked improvement....	793-ab
Two cases of Friedreich's ataxia appearing very early in life.....	267-ab
Dercum's disease, case with symptoms of Dercum's disease and hysterical manifestations; Samuel N. Clark.....	802-ab
Dewey, Richard: Recovery in paranoia.....	803-ab
Dooley, Lucile: Analysis of case of manic-depressive psychosis showing well-marked regressive stages.....	639-ab
Ear and aviation; Eugene R. Lewis.....	167
in stunt flying; Lewis Fisher and Harry Lyman.....	254-ab
Editorial announcement.....	113
Effort syndrome: See Asthenia, neurocirculatory	
Elsberg, Charles A.: Laminectomy for intramedullary (?) tumor of spinal cord removed by two-stage operation.....	658-ab
Lesions encountered in operations for old injuries of spinal cord...	660-ab
Some advances in surgical treatment of injuries of nervous system..	768
Emerson, L. E.: Clinical study of origin, development and disappearance of system of delusions.....	260-ab
Subconscious in its relation to the conscious, preconscious and unconscious	347-ab
Emotions, case bearing on James-Lange theory of; A. Myerson.....	668-ab

INDEX TO VOLUME 1

	PAGE
Encephalitis, epidemic; Arthur J. Hall.....	636-ab
epidemic; S. A. Kinnier Wilson.....	509-ab
lethargic, infectious, prevalence of; I. Abrahamson.....	663-ab
lethargic, so-called; Peter Bassoe.....	799-ab
simulating brain tumor; D. E. Smith.....	796-ab
Endocrinology and vegetative neurology; Walter Timme.....	246-ab
Enebuske, Claes: Arterial tension in mental disease.....	665-ab
Epilepsy, contribution to study of epilepsy and borderline cases; H. Oppenheim.....	339-ab
luminal in epilepsy and in disturbed and excited states.....	654-ab
Epileptiform convulsions in soldiers, study of; R. G. Gordon.....	649-ab
seizures, stimulation of motor cortex in monkey subject to; C. S. Sherrington	125-ab
Epileptoid cases in soldiers; G. Stanford Read.....	508-ab
Essick, Charles R.: Pathology of experimental traumatic abscess of brain	673
Eunuchoidism; Hyman Climenko and Israel Strauss.....	726
Exhaustion pseudoparesis; J. Ramsay Hunt.....	127-ab
Eye and aviation; William H. Wilmer.....	162
Facial nerve, contracture occurring in partial recovery from paralysis of facial nerve and other nerves; William G. Spiller.....	564
paralysis, method for improving treatment of; Charles H. Jaeger....	374-ab
Farrar, Clarence B.: Neuroses among returned soldiers, types and indications	345-ab
Fat in cerebral cortex, microscopic study of; Oscar J. Raeder.....	525
Fatigue; Sidney A. Lord.....	665-ab
Feiss, Henry O.: Peripheral nerve injuries.....	547
Fildes, P.: Unsuspected involvement of central nervous system in syphilis	231
Fisher, Lewis: Ear in stunt flying.....	254-ab
Flournoy, H.: General paralysis in patient with oxycephalic skull....	787-ab
Forebrain (Die Vorderhirnganglien); E. Landau.....	644-ab
Friedman, E. D.: Associated incidence of syphilis of central nervous system and cardiovascular syphilis.....	289
Friedreich's ataxia appearing very early in life, two cases of; Francis X. Dercum.....	267-ab
Gait, cerebellar: a pedographic study; I. Leon Meyers.....	645-ab
Gassing, hysterical aphonia in soldiers with reference to; A. Wilson Gill	648-ab
Gill, A. Wilson: Hysterical aphonia in soldiers with reference to gassing	648-ab
Gilpin, Sherman F.: Case of tabes dorsalis showing results of treat- ment, including drainage of cerebrospinal fluid.....	268-ab
Glioma of brain, trauma and its relation to development of; Israel Strauss	138-ab
Goiter among draft men from the northwest, a report of; Frank P. Brendel and H. M. Helm.....	638-ab
Goodhart, S. Philip: Case of intracranial infiltrating aneurysm at the base	373-ab
Gordon, Alfred: Central nervous system in purpura hemorrhagica....	798-ab
Nystagmus on monocular vision.....	269-ab
Gordon, R. G.: Mental factor in neuroses of war.....	515-ab
Study of epileptiform convulsions in soldiers.....	649-ab
Gregory, M. S.: Neuropsychiatry in recruiting and cantonment.....	89
Hall, Arthur J.: Epidemic encephalitis.....	636-ab
Hall, George W.: Amyotrophic lateral sclerosis.....	365-ab
Probable cerebellar tumor.....	363-ab
Progressive muscular atrophy.....	365-ab
Syringomyelia	365-ab
Transverse myelitis showing Beevor's sign.....	364-ab
Hallucinations, hypnagogic, in a restored epileptic; N. S. Yawger.....	650

INDEX TO VOLUME 1

	PAGE
Hassin, George B.: Histopathology of carcinoma of cerebral membranes	705, 802-ab
Hausman, Louis: Case of occlusion of posterior inferior cerebellar artery with cardiac manifestations and involvement of left vagus nucleus	145
Haynes, H. A.: Case of Mongolism in one of twins.....	717
Head, Henry: The automatic bladder, excessive sweating, and some other reflex conditions in gross injuries of spinal cord.....	343-ab
Helm, H. M.: Report of goiter among draft men from the northwest	638-ab
Henderson, D. K.: War psychoses: A report of six unusual cases showing memory disorder.....	252-ab
War psychoses: Amnesia as a defense mechanism for desertion.....	257-ab
Hoch, August: Clinical study of psychoses characterized by distressed perplexity	415
Holmes, Gordon: Disturbances of spatial orientation and visual attention with loss of stereoscopic vision.....	385
Disturbances of vision by cerebral lesions.....	783-ab
Treatment of secondary and late complications of brain wounds....	788-ab
Horrax, Gilbert: Disturbances of spatial orientation and visual attention with loss of stereoscopic vision.....	385
Howe, Hubert S.: Study of pathology of human and experimental poliomyelitis based on cases occurring during epidemic of 1916 in New York City.....	502-ab
Hunt, J. Ramsay: Exhaustion pseudoparesis.....	127-ab
Preliminary report on a cortico-neural and a strio-neural motor system in peripheral nerves.....	131-ab
Hurst, A. F.: Hysterical element in organic disease and injury of central nervous system.....	646-ab
Hysterical ocular symptoms complicating conjunctivitis.....	648-ab
Hyperpyrexia of doubtful origin, case of; Edward M. Williams.....	137-ab
Hysteria in soldiers; G. McGregor.....	649-ab
treatment of; Julian Wolfsohn.....	350-ab
with multiple operations; Francis X. Dercum.....	266-ab
Hysterical aphonia in soldiers with reference to gassing; A. Wilson Gill	648-ab
element in organic disease and injury of central nervous system; A. F.	
Hurst and J. L. M. Symms.....	646-ab
ocular symptoms complicating conjunctivitis; A. F. Hurst and C. H. Ripman	648-ab
Immerman, S. L.: Remarks on brain tumors in psychopathic subjects..	653-ab
Immigration, bearing of war neuroses on; Lawrence Kolb.....	317
Influenza, cerebello-bulbar polioencephalitis originating during or after epidemics of influenza and of poliomyelitis including record of case of epidemic encephalitis of lethargic type; Charles K. Mills and George Wilson.....	567
neurologic complications of; I. Abrahamson.....	518-ab
Infundibular region, palliative trephining in cases of tumor of; S. P. Kramer	138-ab
Insanity, uniform statistical reports on insanity now assured; James V. May.....	669-ab
Intestines, nerve endings of sensory type in muscular coat of stomach and intestines, preliminary note; F. W. Carpenter.....	382-ab
Jaeger, Charles H.: Method for improving treatment of facial paralysis	374-ab
James-Lange theory of emotions, case bearing on; A. Myerson.....	668-ab
Jelliffe, Smith Ely: Contributions to psychotherapeutic technic through psychoanalysis	334-ab
Jones, Ernest: Theory of symbolism.....	785-ab
Joughin, J. L.: Case of areflexia, asteriognosis and other sensory defects of abiotrophic origin.....	517-ab
Kennedy, Foster: Nature of nervousness in soldiers.....	124-ab

INDEX TO VOLUME 1

	PAGE
Kirby, George H.: Clinical study of psychoses characterized by distressed perplexity.....	415
Klingman, Theophil: Histogenesis of multiple sclerosis.....	39, 193
Knapp, P. C.: Case of cysticercus racemosus (taenia solium) of spinal cord, operation, surgical recovery and death.....	357-ab
Kolb, Lawrence: Bearing of war neuroses on immigration.....	317
Kramer, S. P.: Palliative trephining in cases of tumor of infundibular region	138-ab, 260-ab
Krumholz, S.: Lesion of brachial plexus.....	362-ab
Laminectomy for intramedullary (?) tumor of spinal cord removed by two-stage operation; Charles A. Elsberg.....	658-ab
Landau, E.: Die Vorderhirnganglien.....	644-ab
Lane, Edward B.: The militant.....	359-ab
Lewis, Eugene R.: Ear and aviation.....	167
Lloyd, J. Hendrie: Brain tumor with exact roentgen-ray localization	797-ab
Case of nerve syphilis with acute involvement of auditory nerves and complete deafness.....	651-ab
Lord, Sidney A.: Fatigue.....	665-ab
Lowrey, Lawson G.: Diagnostic problems in psychiatry.....	354-ab
Observations on relationship between syphilis of nervous system and psychoses	642-ab
Ludlum, S. D. W.: Doctrine of neutrality and its relation to mental disorder	136-ab
Luminal, in epilepsy and in disturbed and excited states.....	654-ab
Lyman, Harry: Ear in stunt flying.....	254-ab
Lymph, flow of, in nerves, some experiments; L. B. Alford and S. I. Schwab	260-ab
McCarrison, Robert: Pathogenesis of deficiency disease.....	506-ab
McGregor, G.: Series of hysterical cases in soldiers.....	699-ab
Maitland, H. B.: Unsuspected involvement of central nervous system in syphilis.....	231
Marui, Kiyoyasu: Finer structure of synapse of the Mauthner cell with special consideration of the "Golgi net" of Bethe, nervous terminal feet and the "nervous pericellular net" of Held.....	337-ab
May, James V.: Uniform statistical reports on insanity now assured..	669-ab
Memory disorder, report of six cases of war psychoses showing memory disorder; D. K. Henderson.....	252-ab
Meninges, histopathology of carcinoma of cerebral meninges; G. B. Hassin	705
Menninger, Karl A.: Treatment of nonparetic neurosyphilis by intraventricular injection.....	354-ab
Mental disease, arterial tension in; Claes Enebuske.....	665-ab
disease, doctrine of neutrality and its relation to; S. D. W. Ludlum..	136-ab
extension of the key principle of diagnosis to the genera in certain great groups or orders of mental disease; Elmer E. Southard..	132-ab
genera in certain great groups or orders of mental disease; E. E. Southard	95
Meyers, I. Leon: The cerebellar gait: a pedographic study.....	645-ab
Militant, the; Edward B. Lane.....	359-ab
Military history of the American Neurological Association; Theodore H. Weisenburg.....	1
Miller, William C.: Treatment of dementia praecox by intravenous injections of sodium chlorid together with studies of chlorin content of blood.....	313
Mills, Charles K.: Cerebello-bulbar polioencephalitis originating during or after epidemics of influenza and of poliomyelitis including record of case of epidemic encephalitis of lethargic type.....	567
Mongolism in one of twins, case of; Harold Swanberg and H. A. Haynes	717

INDEX TO VOLUME 1

	PAGE
Moore, J. W.: Hysterical disorders of micturition.....	648-ab
Motor cortex, stimulation of, in monkey subject to epileptiform seizures; C. S. Sherrington.....	125-ab
system, cortico-neural and strio-neural motor system in peripheral nerves, preliminary report on; J. Ramsay Hunt.....	131-ab
Muscular atrophy, progressive; George W. Hall.....	365-ab
Myelitis, transverse, showing Beevor's sign; George W. Hall.....	364-ab
Myerson, Abraham: Case bearing on James-Lange theory of emotions..	668-ab
Personality tests involving principle of multiple choice.....	459
National Committee for Mental Hygiene, ten years of work of, and some plans for its future development; Clifford W. Beers.....	376-ab
Nerve endings of sensory type in muscular coat of stomach and intes- tine, preliminary note; F. W. Carpenter.....	352-ab
median, injury due to stab-wound from ulnar side of hand; T. E. Shea	265-ab
peripheral, conduction in peripheral nerve and in central nervous sys- tem; E. D. Adrian.....	253-ab
peripheral, injuries; George E. Price, Henry O. Feiss and William B. Terhune	547
peripheral, observations on 250 cases of gunshot wounds of; C. Noon	258-ab
peripheral, preliminary report on a cortico-neural and a strio-neural motor system in peripheral nerves; J. Ramsay Hunt.....	131-ab
Nervous system, central, conduction in peripheral nerve and; E. D. Adrian	253-ab
hysterical element in organic disease and injury to; A. F. Hurst and J. L. M. Symms.....	646-ab
intravenous, not intraspinal, use of arsphenamin in syphilis of; B. Sachs	277
some advances in surgical treatment of injuries to nervous system; Charles A. Elsberg.....	768
sympathetic and central nervous systems, interdependence of; David Orr and R. G. Rows.....	127-ab
syphilis of: See Syphilis	
Nervousness in soldiers, nature of; Foster Kennedy.....	124-ab
Neurological therapeutics, constructive plan for advancement in; Walter Timme	659-ab
Neurology, American, opportunity of; Frederick Tilney.....	657-ab
vegetative, and endocrinology; Walter Timme.....	246-ab
Neuropsychiatry in recruiting and cantonment; M. S. Gregory.....	89
Neuroses among returned soldiers, types and indications; Clarence B. Farrar	345-ab
and psychoses of war; William Aldren Turner.....	347-ab
in soldiers, with presentation of cases; Peter Bassoe.....	368-ab
war; Hugh T. Patrick.....	367-ab
war; W. B. Terhune.....	126-ab
war, as physiologic conservations; Sidney I. Schwab.....	579
war, bearing of, on immigration; Lawrence Kolb.....	317
war, mental factor in; R. G. Gordon.....	515-ab
war, some views on diagnosis and treatment; Colin K. Russel.....	25
war, treatment of; James Purves Stewart.....	14
Neurosyphilis: See Syphilis	
Neymann, Clarence A.: Treatment of general paresis.....	250-ab
Noon, C.: Observations on 250 cases of gunshot wounds of peripheral nerves	258-ab
Nystagmus on monocular vision; Alfred Gordon.....	269-ab
Obituaries:	
Major Alfred Reginald Allen, U. S. A., 1876-1918.....	115
James Jackson Putnam, 1846-1918.....	333

INDEX TO VOLUME 1

	PAGE
Oculo-cardiac reflex, note on; R. M. Stewart.....	126-ab
O'Malley, Mary: Certain pluriglandular anomalous functions associated with psychopathic sexual interests.....	640-ab
Oppenheim, H.: Contribution to study of epilepsy and borderline cases..	339-ab
Orr, David: Interdependence of sympathetic and central nervous systems	127-ab
Orton, Samuel T.: Histological evidence of path of invasion of brain in general paresis.....	133-ab, 285
Pain, mechanism of, from physiological standpoint; Joseph Byrne.....	521-ab
Paralysis, contracture occurring in partial recovery from paralysis of facial nerve and other nerves; William G. Spiller.....	564
facial, method for improving treatment of; Charles H. Jaeger.....	374-ab
general, histological evidence of path of invasion of brain in general paresis; Samuel T. Orton.....	133-ab, 285
general, in patient with oxycephalic skull; H. Flournoy.....	787-ab
general, treatment of; Clarence A. Neymann and Nathaniel H. Brush	250-ab
Paranoia, recovery in; Richard Dewey.....	803-ab
Paresis: See Paralysis, general	
Parnell, R. J. G.: Unsuspected involvement of central nervous system in syphilis.....	231
Patrick, Hugh T.: War neuroses.....	367-ab
Perplexity, psychoses characterized by distressed perplexity, clinical study of; August Hoch and George H. Kirby.....	415
Personality, graphic representation of personality and psychosis, suggestions for a scheme of; H. Douglas Singer.....	249-ab
systematic study of, in estimating adaptability; G. S. Amsden.....	301
tests involving principle of multiple choice; Abraham Myerson.....	459
Pessimists, psychopathic and non-psychopathic; E. E. Southard.....	664-ab
Pineal body, morphology and evolutionary significance of; Frederick Tilney and Luther F. Warren.....	778-ab
Pituitary disturbance in its relation to psychosis of adolescence; Beverley Tucker.....	503-ab
Pluriglandular anomalous functions associated with psychopathic sexual interests; Mary O'Malley.....	640-ab
compensatory syndrome, new; Walter Timme.....	505-ab
Polioencephalitis, cerebello-bulbar, originating during or after epidemics of influenza and of poliomyelitis including record of case of epidemic encephalitis of the lethargic type; Charles K. Mills and George Wilson.....	567
Poliomyelitis, cerebello-bulbar polioencephalitis originating during or after epidemics of influenza and of poliomyelitis including record of case of epidemic encephalitis of lethargic type; Charles K. Mills and George Wilson.....	567
study of pathology of human and experimental poliomyelitis, based on cases occurring during epidemic of 1916 in New York City; Hubert S. Howe	502-ab
Price, George E.: Peripheral nerve injuries.....	547
Prothymia: note on morale-concept in Xenophon's cyropedia; E. E. Southard	358-ab
Pseudoparesis, exhaustion; J. Ramsay Hunt.....	127-ab
Psychiatry, diagnostic problems in; Lawson G. Lowrey.....	354-ab
lessons in psychiatry taught by war; H. Douglas Singer.....	367-ab
psychologic point of view in; E. Bleuler.....	128-ab
Psychoanalysis, contributions to psychotherapeutic technic through psychoanalysis; Smith Ely Jelliffe.....	334-ab
treatment of dementia praecox by; Isador H. Coriat.....	643-ab
Psychoneuroses, general considerations on urinary symptoms in psychoneuroses and psychoses; C. Macfie Campbell.....	256-ab
war, predisposing factors of; Julian Wolfsohn.....	125-ab

INDEX TO VOLUME 1

	PAGE
Psychoses and neuroses of war; William Aldren Turner.....	347-ab
characterized by distressed perplexity, clinical study of; August Hoch and George H. Kirby.....	415
general considerations on urinary symptoms in psychoneuroses and; C. Macfie Campbell.....	256-ab
manic-depressive, showing well-marked regressive stages, analysis of case of; Lucile Dooley.....	639-ab
observations on relationship between syphilis of nervous system and psychoses; Lawson G. Lowrey.....	642-ab
of adolescence, pituitary disturbance in relation to; Beverley Tucker	503-ab
official classification of psychoses; James V. May.....	669-ab
suggestions for a scheme of graphic representation of personality and psychosis; H. Douglas Singer.....	249-ab
war, amnesia as defense mechanism for desertion; D. K. Henderson	257-ab
war, report of six cases showing memory disorder; D. K. Henderson	252-ab
Purpura hemorrhagica, central nervous system in; Alfred Gordon....	798-ab
Raeder, Oscar J.: Microscopic study of fat in cerebral cortex.....	525
Read, G. Stanford: Study of two epileptoid cases in soldiers.....	508-ab
Reed, Alfred C.: Unusual case of vagotonia.....	560
Reynell, W. R.: Hysterical vomiting in soldiers.....	647-ab
Riddock, George: Dissociation of visual perceptions due to occipital injuries with reference to appreciation of movement.....	513-ab
Reflex functions of completely divided spinal cord in man.....	335-ab
The automatic bladder, excessive sweating, and some other reflex con- ditions in gross injuries of spinal cord.....	343-ab
Ripman, C. H.: Hysterical ocular symptoms complicating conjunctivitis	648-ab
Rosanoff, Saloff: General considerations on campyocormia.....	641-ab
Rows, R. G.: Interdependence of sympathetic and central nervous systems	127-ab
Russel, Colin K.: War neuroses.....	25
Sachs, B.: Intravenous, not intraspinal use of arsphenamin in syphilis of nervous system.....	277
Salmon, Thomas W.: Shell shock among troops.....	353-ab
Schaller, W. F.: Complete division of spinal cord in lower dorsal region	77, 130-ab
Pathogenesis of tabes dorsalis.....	749
Spinal cord injuries in warfare, symptomatology and diagnosis.....	471
Schwab, Sidney I.: Some experiments bearing on flow of lymph in nerves	260-ab
War neuroses as physiologic conservations.....	579
Sclerosis, amyotrophic, lateral; George W. Hall.....	365-ab
multiple, a probable etiologic factor in; Malcolm S. Woodbury.....	408
multiple, histogenesis of; Theophil Klingman.....	39, 193
multiple, subacute form of; William G. Spiller.....	219
Sexual interests, psychopathic, certain pluriglandular anomalous func- tions associated with; Mary O'Malley.....	640-ab
Shea, T. E.: Case of median nerve injury due to stab-wound from ulnar side of hand.....	265-ab
Sherrington, C. S.: Stimulation of motor cortex in monkey subject to epileptiform seizures.....	125-ab
Shock, shell, among troops; Thomas W. Salmon.....	353-ab
shell, so-called: the remedy; Francis X. Dercum.....	65
shell, treatment of cases in an advanced neurological center; William Brown	342-ab
Singer, H. Douglas: Some lessons in psychiatry taught by war.....	367-ab
Suggestions for scheme of graphic representation of personality and psychosis	249-ab

INDEX TO VOLUME 1

	PAGE
Smith, D. E.: Encephalitis simulating brain tumor.....	796-ab
Society Transactions:	
American Neurological Association.....	130
Boston Society of Psychiatry and Neurology.....	354, 357, 664, 667
Chicago Neurological Society.....	362, 367, 799
New York Neurological Society.....	373, 517, 655
Philadelphia Neurological Society.....	262, 650, 792
Sodium chlorid, treatment of dementia praecox by intravenous injections of, together with studies of chlorin content of blood; William C. Miller	313
Soldiers, epileptiform convulsions in; R. G. Gordon.....	649-ab
hysterical cases in; G. McGregor.....	649-ab
hysterical vomiting in; W. R. Reynell.....	647-ab
neuroses among returned soldiers, types and indications; Clarence B. Farrar.....	345-ab
neuroses in, with presentation of cases; Peter Bassoe.....	368-ab
Southard, Elmer E.: An extension of the key principle of diagnosis to the genera in certain great groups or orders of mental disease....	132-ab
Focality of microscopic brain lesions found in dementia praecox.....	172
Non-dementia non-praecox; note on advantages to mental hygiene of extirpating a term.....	667-ab
Pessimists, psychopathic and non-psychopathic.....	664-ab
Prothymia: note on morale-concept in Xenophon's Cyropedia.....	358-ab
The genera in certain great groups or orders of mental disease.....	95
Somnolence, two cases with attacks of somnolence probably of pituitary origin; B. P. Weiss.....	792-ab
Spatial orientation and visual attention, disturbances of, with loss of stereoscopic vision; Gordon Holmes and Gilbert Horrax.....	385
Spiller, William G.: Contracture occurring in partial recovery from paralysis of facial nerve and other nerves.....	564
Special communication.....	797-ab
Subacute form of multiple sclerosis.....	219
Spinal cord, automatic bladder and excessive sweating and some other reflex conditions in gross injuries of spinal cord; Henry Head and George Riddoch.....	343-ab
complete division of spinal cord in lower dorsal region: a case with conservation of spinal reflexes below level of lesion; W. F. Schaller	77, 130-ab
cysticercus racemosus (taenia solium) of, operation, surgical recovery and death; P. C. Knapp.....	357-ab
injuries in warfare, symptomatology and diagnosis; Walter F. Schaller	471
laminectomy for intramedullary (?) tumor of spinal cord removed by two-stage operation; Charles A. Elsberg.....	658-ab
lesions encountered in operations for old injuries of; Charles A. Elsberg	660-ab
reflex functions of completely divided spinal cord in man; George Riddoch	335-ab
tumor of, case of successful removal of; C. C. Beling and Alfred S. Taylor	655-ab
Stealing, psychologic study of, in juvenile delinquency; L. Pierce Clark	535
Stewart, James Purves: Treatment of war neuroses.....	14
Stewart, R. M.: Note on oculo-cardiac reflex.....	126-ab
Stomach, nerve endings of sensory type in muscular coat of stomach and intestines, preliminary note; F. W. Carpenter.....	352-ab
Strauss, Israel: Eunuchoidism.....	726
Trauma and its relation to development of glioma of brain.....	138-ab

INDEX TO VOLUME 1

	PAGE
Strecker, Edward A.: Certain clinical aspects of "late catatonia" with report of cases.....	780-ab
Subarachnoid space, irrigation of; L. B. Alford.....	503-ab
Subconscious in its relation to the conscious, preconscious and unconscious; L. E. Emerson.....	347-ab
Sugita, Naoki: Comparative studies on growth of cerebral cortex.....	789-ab
Swanberg, Harold: Case of Mongolism in one of twins.....	717
Sweating, excessive, and automatic bladder and some other reflex conditions in gross injuries of spinal cord; Henry Head and George Riddoch	343-ab
Symbolism, theory of; Ernest Jones.....	785-ab
Symms, J. L. M.: Hysterical element in organic disease and injury of central nervous system.....	646-ab
Synapse, on the finer structures of the synapse of the Mauthner cell with special consideration of the "Golgi net" of Bethe, nervous terminal feet and the "nervous pericellular net" of Held; Kiyoyasu Marui	337-ab
Syphilis hereditaria tarda with "tip-toe" gait, case of; N. S. Yawger..	262-ab
nerve, with acute involvement of auditory nerves and complete deafness; James Hendrie Lloyd.....	651-ab
observations on relationship between syphilis of nervous system and psychoses; Lawson G. Lowrey.....	642-ab
of central nervous system and cardiovascular syphilis, associated incidence of; E. D. Friedman.....	289
of nervous system, intravenous not intraspinal use of arsphenamin in; B. Sachs	277
treatment of nonparetic neurosyphilis by intraventricular injection; Karl A. Menninger.....	354-ab
unsuspected involvement of central nervous system in syphilis; study of 624 unselected cases; P. Fildes, R. J. G. Parnell and H. B. Maitland	231
Syringomyelia; George W. Hall.....	365-ab
Tabes dorsalis, pathogenesis of, with remarks on treatment of tabes based on consideration of pathology; Walter F. Schaller.....	749
showing results of treatment including drainage of cerebrospinal fluid; Sherman F. Gilpin.....	268-ab
Taft, A. E.: Estimation of proportions of gray and white matter in human brain.....	346-ab
Taylor, Alfred S.: Case of successful removal of tumor of spinal cord	655-ab
Terhune, William B.: Peripheral nerve injuries.....	547
War neuroses.....	126-ab
Therapeutics, neurological, constructive plan for advancement in; Walter Timme.....	659-ab
Tilney, Frederick: Morphology and evolutionary significance of pineal body	778-ab
Opportunity of American neurology.....	657-ab
Timme, Walter: A new pluriglandular compensatory syndrome.....	505-ab
Constructive plan for advancement in neurological therapeutics.....	659-ab
Vegetative neurology and endocrinology.....	246-ab
Trephining, palliative, in cases of tumor of infundibular region; S. P. Kramer	138-ab, 260-ab
Tucker, Beverley: Pituitary disturbance in its relation to psychosis of adolescence	503-ab
Tumors, brain, in psychopathic subjects; S. L. Immerman.....	653-ab
brain, with exact roentgen-ray localization; J. Hendrie Lloyd.....	797-ab
cerebellar, probable; George W. Hall.....	363-ab
of infundibular region, palliative trephining in cases of; S. P. Kramer	138-ab
intramedullary (?), of spinal cord removed by two-stage operation, laminectomy for; Charles A. Elsberg.....	658-ab

INDEX TO VOLUME 1

TUMORS—Continued	PAGE
of spinal cord, case of successful removal of; C. C. Beling and Alfred S. Taylor.....	655-ab
palliative trephining in cases of tumor of infundibular region; S. P. Kramer	260-ab
Turner, William Aldren: Neuroses and psychoses of war.....	347-ab
Urinary system, case of childhood conflicts with prominent reference to urinary system; with general considerations on urinary symptoms in psychoneuroses and psychoses; C. Macfie Campbell.....	256-ab
Urination, hysterical disorders of; J. W. Moore.....	648-ab
Vagotonia, unusual case of; Alfred C. Reed.....	560
Van Woerkom, W.: Loss of tonicity and incoordination of voluntary movements	782-ab
Vision, dissociation of visual perceptions due to occipital injuries with reference to appreciation of movement; George Riddock.....	513-ab
disturbances of, by cerebral lesions; Gordon Holmes.....	783-ab
disturbances of spatial orientation and visual attention, with loss of stereoscopic vision; Gordon Holmes and Gilbert Horrax.....	385
Voluntary movements, loss of tonicity and incoordination of voluntary movements; W. Van Woerkom.....	782-ab
Vomiting, hysterical, in soldiers; W. R. Reynell.....	647-ab
War, lessons in psychiatry taught by; H. Douglas Singer.....	367-ab
neuroses; Hugh T. Patrick.....	367-ab
neuroses; W. B. Terhune.....	126-ab
neuroses and psychoses of; William Aldren Turner.....	347-ab
neuroses as physiologic conservations; Sidney I. Schwab.....	579
neuroses, bearing of, on immigration; Lawrence Kolb.....	317
neuroses of, mental factor in; R. G. Gordon.....	515-ab
neuroses: some views on diagnosis and treatment; Colin K. Russel..	25
neuroses, treatment of; James Purves Stewart.....	14
psychoneuroses, predisposing factors of; Julian Wolfsohn.....	125-ab
psychoses, amnesia as defense mechanism for desertion; D. K. Henderson	257-ab
psychoses, report of six cases showing memory disorder; D. K. Henderson	252-ab
Warren, Luther F.: Morphology and evolutionary significance of pineal body	778-ab
Weisenburg, Theodore H.: The military history of the American Neurological Association.....	1
Weiss, B. P.: Two cases with attacks of somnolence, probably of pituitary origin.....	792-ab
Williams, Edward M.: Case of hyperpyrexia of doubtful origin....	137-ab
Wilmer, William H.: Eye and aviation.....	162
Wilson, George: Cerebello-bulbar polioencephalitis originating during or after epidemics of influenza and of poliomyelitis including record of case of epidemic encephalitis of lethargic type.....	567
Wilson, S. A. Kinnier: Epidemic encephalitis.....	509-ab
Wolfsohn, Julian: Predisposing factors of war psychoneuroses.....	125-ab
Treatment of hysteria.....	350-ab
Woodbury, Malcolm S.: Probable etiologic factor in multiple sclerosis	408
Wounds, gunshot, of peripheral nerves, observations on 250 cases of; C. Noon.....	258-ab
Xenophon's Cyropedia, note on morale-concept in; E. E. Southard...	358-ab
Yawger, N. S.: Hypnagogic hallucinations in a restored epileptic....	650
Syphilis hereditaria tarda, with "tip-toe" gait.....	262-ab

Archives of Neurology and Psychiatry

Vol. I

JANUARY, 1919

No. 1

THE MILITARY HISTORY OF THE AMERICAN NEUROLOGICAL ASSOCIATION

PRESIDENTIAL ADDRESS *

THEODORE H. WEISENBURG, M.D.
Major, M. C., U. S. Army

PHILADELPHIA

In times such as these it is particularly appropriate that the work of the Association should concern itself with the military problems brought about by the European War. Three-fourths of the program has been devoted to military topics, and an attempt has been made to cover every neurologic phase. In conveying to our guests our grateful appreciation for their cordial and willing acceptance of the invitation of the Association to read papers before it, I feel that I am expressing the sentiment of every member. The Association is no less thankful to those of its members in active military service who so cheerfully consented to read papers before it.

No previous war has made such demands on the medical profession of all the belligerents and particularly on the neurologists. While of course all wars have produced a great many head, spine and peripheral nerve injuries, with the ever-increasing mechanical methods of warfare and the more general use of artillery, the number of wounds of the nervous system has greatly increased.

After our entrance into the present war it was very soon found that while the bulk of the medical work was largely surgical, there were so many eye, ear, nerve and other injuries that special departments had to be created in the Surgeon-General's Office.

A NEUROLOGIC DEPARTMENT IN THE ARMY

The neurologic specialty is represented in the division of neurology and psychiatry, at the head of which is Col. Pearce Bailey, a former president of the Association. This I believe is the first time that an army has ever created a special neurologic department. Its work has grown tremendously, and while there may have been some skepticism

* Submitted for publication Oct. 30, 1918.

* President's address read at the Annual Meeting of the American Neurological Association, Atlantic City, N. J., May, 1918.

in the beginning, the work of the neurologists and psychiatrists has been of such exceptional merit that universal recognition has been given it by other branches of the service. So much so that while at first the work of the neurologist was chiefly confined to the examination of the recruit, cantonment and base hospitals, new fields are constantly opening up for which a large number of new men are needed. Division neurologists have been created and new opportunities have arisen through aviation, which as the aviation symposium will demonstrate, is almost altogether a neurologic problem, and one which should be of the greatest interest.

Reconstruction, which is considered by the Surgeon-General's Office as probably the biggest problem before it, is of course of acute interest to neurologists, for about 20 per cent. of the wounded have some injury to the nervous system. Reconstruction units are now in the process of organization, and already a call has been issued for neurologists for this branch of the service.

NEUROLOGIC WORK ABROAD

Abroad the neurologic work is somewhat different, since the mental defects and the undesirable recruits are weeded out in this country, and the neurologist is chiefly concerned with the large group of functional conditions known as shell shock, and the many traumatic injuries produced by shell and bullet wounds. Even now the literature is replete with many excellent studies based on focal and other injuries of the nervous system. It is no exaggeration to say that focal localization of the nervous system will be rewritten as a result of this war.

The work of the Division of Neurology and Psychiatry has been greatly helped by the National Committee for Mental Hygiene. This organization through its medical director, Col. Thomas W. Salmon, who is now at the head of the Division of Neurology and Psychiatry in France, and its able associate medical director, Major Frankwood E. Williams, has been very active in assisting the division in obtaining medical officers, nurses and attendants, and in the organization of Base Hospital No. 117, which is the first American neuro-psychiatric hospital established in France.

This work has been accomplished through its War Work Committee, whose first chairman was Dr. Pearce Bailey. Recently Dr. Bailey resigned, and Dr. Charles L. Dana is now its active head. On the general war committee there are representatives of every neurologic and psychiatric society in the country. Its executive committee is composed of the following physicians:

Charles L. Dana, Chairman
George H. Kirby
E. E. Southard
William L. Russell

Frederick Tilney
T. H. Weisenburg
Frankwood E. Williams

With the exception of two, all of these men are members of this Association. It is particularly fortunate that there exists such an organization as this that can so admirably act as a civilian clearing house for the military division in Washington.

A new Division of Head Surgery has also been created in the Surgeon-General's Office, and a special head hospital is being built of which one of our members, Major Charles H. Frazier, is to be the chief. In this connection it might be well to add that one of our distinguished members, Lieut.-Col. Harvey Cushing, director of Base Hospital No. 5, has been on duty in the war zone since our entrance in the war and is adding fresh laurels to American nervous surgery. Surgeons from all parts of the country, especially adapted for nervous work, have been selected from among other members of the Medical Reserve Corps and special neuro-surgical courses were and are still being given for their benefit. The first to be established was that in Philadelphia in the University of Pennsylvania under the military direction of Major Charles H. Frazier. The second was created in New York under the military direction of Dr. Charles A. Elsberg, the third in St. Louis, under the direction of Dr. Ernest Sachs and the fourth in Chicago under the direction of Major Dean D. Lewis. All of these gentlemen with the exception of Major Lewis are members of the Association. Associated with them were other members of the American Neurological Association who bore the brunt of the teaching.

Under the direction of the Division of Neurology and Psychiatry neuro-psychiatric instruction was given also in New York, Boston, Ann Arbor, Baltimore, Washington and Philadelphia, under the military direction of Drs. W. Timme, E. E. Southard, A. M. Barrett, Adolf Myer, William A. White, and T. H. Weisenburg. As in the neurosurgical courses the bulk of the teaching was done by the local members of the Association.

CREATION OF EXAMINING STATIONS

An interesting development has occurred in the aviation section in the examination of candidates for this branch of the service. Under the direction of Lieut.-Col. Isaac H. Jones a large number of examining stations were created. In these units there is an otologist who does the Bárány tests, an internist and an ophthalmologist. The purpose of these special tests is to determine whether or not the vestibular apparatus is normal. As a consequence a great deal of valuable data has been collected and a lot of information obtained as to the action of the vestibular nerve. But most interesting is the fact that these physicians as well as the large number of surgeons under instruction in the various neurosurgical schools have had their attention called to the importance of the nervous system, and it is safe to say that there

will be a greater interest in the study of neurology and psychiatry after the war.

While war brings about a great deal of misery and an unnecessary amount of unhappiness, at the same time it produces a reawakening in the lives of those who for one reason or another take part. The medical profession and the people indirectly are bound to gain a lasting benefit. Before the war the vast number of those men who now compose the Medical Reserve Corps were general practitioners in various parts of the country, and while they were good physicians, it is probable that most of them were not keeping up with the advances of their profession. This war has brought about a new state of affairs. Men are taken into the service and are given general military training, and if they show any aptitude in a special line are trained in that work. Special courses have been given in almost every branch of medicine in many of the medical centers of the country. While most of these schools are now being abandoned there has been created in Fort Oglethorpe, Ga., probably the largest postgraduate school in the world, and, if the plans of the Surgeon-General's Office go through, instruction will be given in every specialty. At the present time there are over 3,000 Medical Reserve Corps officers on duty. A neuropsychiatric course is included. All of this means that the medical profession will be inspired to do much better work after the war.

Of the 120 active members of the American Neurological Association, twenty-nine have so far accepted commissions. Of these, twenty-six are in the Army, one in the Navy and two are in the service of our allies. Seventeen have served or are still serving as contract surgeons, altogether a very proud showing and in accord with the traditions of the Association. The names of the men who have so far accepted commissions follow:

ARMY

Col. Pearce Bailey.....	New York	Major Daniel J. McCarthy.....	.....
Lieut.-Col. Harvey Cushing....	Boston	.....	Philadelphia
Major Herman M. Adler.....	Chicago	Major Stewart Paton.....	.....
Major Alfred Reginald Allen.....	.....	.....	Princeton, N. J.
.....	Philadelphia	Major John H. W. Rhein.....	.....
Major E. D. Bondurant..	Mobile, Ala.	.....	Philadelphia
Major Sanger Brown..	Kenilworth, Ill.	Major Sidney I. Schwab....	St. Louis
Major William B. Cadwalader....	.....	Major Elmer E. Southard....	Boston
.....	Philadelphia	Major T. H. Weisenburg.....	.....
Major Joseph Collins.....	New York	.....	Philadelphia
Major Charles H. Frazier.....	.....	Major Edwin G. Zabriskie..	New York
.....	Philadelphia	Major Henry Cotton (resigned)...	.....
Major Menas S. Gregory...	New York	.....	Trenton, N. J.
Major Graeme M. Hammond.....	.....	Capt. James B. Ayer.....	Boston
.....	New York	Capt. Louis Casamajor....	New York
Major J. R. Hunt.....	New York	Capt. George E. Price....	Philadelphia
Major Simon P. Kramer...	Cincinnati	First Lieut. Augustus A. Eshner....	.....
Major Samuel Leopold...	Philadelphia	.....	Philadelphia

NAVY

P. A. Surg. Walter F. Schaller, U. S. N. R. F.....San Francisco

FOREIGN SERVICE

Major Foster Kennedy, R.A.M.C.....New York (English service)

Lieut.-Col. Colin K. Russell, C.A.M.C.....Montreal, Canada (Canadian service)

CONTRACT SURGEONS

Albert M. Barrett..Ann Arbor, Mich.

Peter Bassoc.....Chicago

Malcolm Andrews Bliss.....St. Louis

Carl D. Camp.....Ann Arbor, Mich.

Charles Macfie Campbell...Baltimore

Allen Ross Diefendorf.....

.....New Haven, Conn.

Charles A. Elsberg.....New York

Edward M. Hummel....New Orleans

Smith Ely Jelliffe.....New York

S. D. W. Ludlum.....Philadelphia

Adolf Myer.....Baltimore

Hugh T. Patrick.....Chicago

James J. Putnam.....Boston

Ernest Sachs.....St. Louis

Alfred S. Taylor.....New York

Frederick Tilney.....New York

Walter Timme.....New York

I have no doubt that every member of the American Neurological Association has in some way or other been of military assistance to the government either as teacher, writer or contributor to textbooks, members of examining or advisory boards or in other civilian capacity. Even before we entered the war a number of our members served in the American ambulance in France in the capacity of neurologist or surgeon. Among these were Drs. Harvey Cushing, John Jenks Thomas, and Daniel J. McCarthy. Others have rendered valuable service in a diplomatic capacity, notably Dr. McCarthy, who as a member of Ambassador Gerard's staff in Berlin did excellent work. Dr. McCarthy wrote up his interesting experiences in a book entitled "The Prisoner of War in Germany." Later on Dr. McCarthy accompanied the Red Cross Commission to Russia. At the present time Dr. Morton Prince, one of our distinguished members, is in Europe on a very important mission for the government.

EARLY HISTORY OF THE ASSOCIATION

As it is, of course, well known the Association first met in New York City on June 2, 1875, as a result of a call issued on December 15, 1874, signed by Drs. William A. Hammond, Roberts Bartholow, Meredith Clymer, J. S. Jewell, E. C. Seguin, James J. Putnam and T. M. B. Cross. There were thirty-five original members. Of these the following eighteen physicians were present at its first meeting:

Meredith Clymer

William A. Hammond

J. S. Jewell

J. J. Putnam

T. M. B. Cross

F. D. Lente

J. J. Mason

F. P. Kinnicutt

A. D. Rockwell

A. McL. Hamilton

S. G. Webber

D. F. Lincoln

E. R. Hun,

John Van Bibber

N. B. Emerson

T. A. McBride

Walter Hay.

E. C. Seguin

The other original members of the Association were:

J. K. Bauduy	Robert T. Edes
John C. Shaw	F. T. Miles
D. B. St. John Roosa	William Pepper
E. G. Loring	H. C. Wood
John C. Dalton	H. M. Bannister
C. H. Clarke	J. S. Lombard
H. D. Schmidt	S. Weir Mitchell
S. M. Burnett	Roberts Bartholow
J. W. Arnold	

The first presidency was offered to S. Weir Mitchell who was unable to accept, and as a consequence the following were the first officers of the Association:

J. S. Jewell, Chicago, President.
 E. H. Clarke, Boston, First Vice-President.
 F. T. Miles, Baltimore, Second Vice-President.
 J. J. Mason, New York, Corresponding Secretary.
 E. C. Seguin, New York, Recording Secretary and Treasurer.
 J. W. S. Arnold, New York, Curator.

Of the original thirty-five members, the following seven physicians are alive:

H. M. Bannister	J. J. Putnam
R. T. Edes	S. G. Webber
E. R. Hun	H. C. Wood
J. J. Mason	

Fourteen had military service. Besides that there were others with military records but who joined the Association subsequent to its formation. These physicians were:

Daniel R. Brower	Wharton Sinkler
S. V. Clevenger	Burt G. Wilder
C. K. Mills	

RECORDS OF OUR EARLY MEMBERS

The Association can well be proud of the records of these men. Chief among these was William Alexander Hammond, Surgeon-General of the United States Army during the Civil War. Dr. Hammond soon after taking his degree in medicine in 1848 entered the U. S. service as assistant surgeon in 1849. He served at various frontier stations, participating in numerous Indian campaigns and occupying his leisure time chiefly with physiologic and botanical investigations. In 1860 he resigned from the military service, but on the outbreak of the Civil War reentered as an assistant surgeon. On account of his previous experience he was at once assigned to administrative work in the organization of hospitals and sanitary stations in which he was so successful as to attract the attention of the sanitary commission, who being dissatisfied with the administration of the medical department of the army successfully urged his appointment as

surgeon-general, he being appointed to this position with a rank of brigadier-general in 1862. The medical department at once improved in its efficiency and, from being scarcely able to provide for an army of 15,000, became fully competent to handle an army of 1,000,000. Dr. Hammond's promotion, however, over the heads of others created a great deal of antagonism, and particularly his masterful and forceful administration so clashed with the spirit of Edwin M. Stanton, then Secretary of War, that he was court-martialed and dismissed from the service in 1864. A review of the proceedings was made by the President of the United States by special Act of Congress in 1878, as a result of which he was restored to his rank and placed on the retired list of the army.

Dr. Hammond founded the Army Medical Museum, called by the senate military committee long after "an institution universally admitted to be one of the proudest scientific monuments of any age or country," and he originated the ambulance corps, which was not adopted until after his displacement.

Dr. Hammond not only contributed largely to the literature, but wrote perhaps the first textbook on neurology in this country, and occupied various important teaching positions. In 1861 he became professor of anatomy and physiology in the University of Maryland and in 1866-1867 in the College of Physicians and Surgeons he delivered the first course of lectures ever given in New York on "Diseases of the Mind and Nervous System," and in 1867 a chair for this branch was created for him in the Bellevue Hospital Medical College; this he held until 1873 and then was transferred to a similar professorship in his alma mater, the University of the City of New York, where he lectured until 1882. In 1882, he and some of his colleagues in the City University resigned their chairs and founded the New York Postgraduate Medical School in which he assumed the professorship of his specialty.

Perhaps the most distinguished member of the Association who saw active service in the Civil War was Dr. Silas Weir Mitchell. Of the many biographical sketches of Dr. Mitchell, the best one is that written by his friend and colleague, Dr. Charles K. Mills. In referring to Dr. Mitchell's war records, Dr. Mills says:

The Civil War made a profound impression both upon the life and the work of Mitchell. At the time of the breaking out of the war he was a little more than 30 years of age, vigorous and full of the passion to know and to do. He lived in the midst of the recruiting camps, and saw thousands marching through Philadelphia on their way to the front. He had relatives in the Army and had himself a place in the work of the Sanitary Commission and of the Army hospitals. Early in the war he was appointed an acting assistant surgeon in the Army. In two of the large military hospitals of Philadelphia wards for the study and treatment of injuries of the peripheral nerves and central nervous

system were set apart for him. As the war proceeded, in 1863 a large hospital was established at Turners Lane, in what was then a Philadelphia suburb. The concentration here of several hundred patients offered opportunities for study which were seized and improved by Mitchell and his colleagues, Morehouse and Keen.

As a result of his experiences he published many papers. Among the first was "Sudden Palsy, the Result of Gunshot Wounds in Remote Regions of the Body." Then came a paper on malingering and the simulation of paralyzes and epilepsies. In 1866 he published an important paper on paralysis from peripheral irritation.

New symptoms like causalgia or burning pain, observations on reflex paralysis, new data in diagnosis, and new therapeutic measures, medical and surgical, were among the results of this wartime work. On the foundation of the material first collected and published by him and his colleagues, appeared in 1872 an elaborate and systematic volume by him on "Injuries to Nerves and their Consequences," and many years later a valuable work by his son, Dr. John K. Mitchell, on the remote consequences of nerve injuries based upon a study of the conditions remaining in surviving patients described in the first volume. Mitchell's "Injuries to Nerves" has been translated into several languages and continues to hold first rank in neurologic literature.

Dr. Mills in discussing Dr. Mitchell's writings says:

Not only was his experience as a surgeon in the Civil War a determining influence in his life as a physician and medical writer, but out of that period came much that crystallized later in Mitchell's novels, dealing as many of them do with hospital incidents and descriptions of the march, bivouac, and battle. An active figure in this heroic period of our country's history, some of his more important novels drew their inspiration from the personnel and incidents of the great war. "Roland Blake" deals largely with the subject of espionage and Grant's sledgehammer campaign through the Wilderness. "Constance Trescott," which the author and others have regarded as his best novel, deals with the reconstruction period, throwing light on conditions in the South after the war. "Westways" brings vividly to the mind of the reader the consolidating antagonisms of the North and the South in the trying period immediately preceding the war, and in this novel is found an excellent description of the Battle of Gettysburg. The militant spirit and the clash of arms are recalled in some of his poems, as in the lyrics of "The Sinking of the Cumberland," and in his drama, "Francis Drake," and "Kearsarge" and "The Eve of Battle."

As can be readily appreciated it has been impossible to obtain a complete military record of the early members of the Association, although a persistent effort has been made by the writer. The record of our first president, Dr. J. S. Jewell, has been difficult to obtain. I was able to get the following information, however, from Dr. H. M. Bannister through the kindness of Dr. Hugh T. Patrick. Dr. Jewell

was connected with the First Illinois Artillery and saw service in Grant's campaign at Donelson and Shiloh.

Dr. Roberts Bartholow, the third president of the Association, like Dr. Hammond, also entered the Army very early in his career, and was one of the force sent to maintain order among the Mormons and Indians in the West in the Brigham Young days. Four years of camping in that wild country gave him wide experience in fevers and gunshot wounds and he no sooner returned home than the Civil War broke out and gave him three more years in military and surgical experience. Dr. Bartholow resigned from the Army in 1864.

Among his appointments were professor of medical chemistry and afterward professor of practice of medicine, Medical College of Ohio, and professor of materia medica, Jefferson Medical College.

His writings included many critical, sarcastic but fascinating articles for *The Clinic*, of which he was founder and editor; also books on "Spermatorrhea," "Materia Medica and Therapeutics," and "A Treatise on the Practice of Medicine."

Dr. Meredith Clymer, one of the signers of the call for the formation of the Association served throughout the entire Civil War. He was medical officer in charge of the sick and wounded in Washington, D. C., during 1862-1863, and medical director of the Department of the South in 1865. He became professor of nervous and mental diseases in Albany Medical College in 1871, holding that position until 1876.

Dr. J. C. Dalton entered the United States service in April, 1861, as surgeon to the famous Seventh New York Regiment, and in August of the same year was appointed brigadier-surgeon of volunteers, and served as such until March, 1864, when he resigned from the Army. After his return to civil practice in New York he resumed his duties at the College of Physicians and Surgeons, being appointed to the chair of physiology in that college. Here he remained until his death. Dr. Dalton was a distinguished author and wrote many excellent papers, among these being "Topographical Anatomy of the Brain," and "Physiology of the Cerebellum."

Dr. Robert T. Edes, one of the five surviving original members, graduated from the Harvard Medical School in 1861 and promptly entered the Navy as an active assistant surgeon. He was commissioned assistant surgeon in the following January and was surgeon of the second division of the mortar flotilla at the capture of the forts below New Orleans, being afterward at Vicksburg and Port Hudson and later transferred to the *U. S. S. Black Hawk*, the flagship of the Mississippi squadron. Dr. Edes resigned in 1865 while attached to the *U. S. S. Colorado*.

In 1870 he was appointed assistant professor of materia medica to Harvard University, professor in 1875, Jackson professor of clinical

medicine in 1884, and in 1891 was elected visiting physician to the Boston City Hospital.

Dr. D. F. Lincoln also served in the U. S. Navy, entering as an acting assistant surgeon in 1862. He was on blockade duty off Mobile, Ala., and Wilmington, N. C. He resigned in 1864.

Dr. F. T. Miles, the second president of the Association and one of its most distinguished members, served in the southern army, entering the line in the regular service and rapidly rose to be captain in an infantry regiment. He was later transferred into the medical service. Dr. Miles was a student of Agassiz and was actually teaching anatomy, being the professor of anatomy in the University of Charleston, when the sound of cannon firing on Fort Sumter broke up the lecture. He with his students immediately joined the Army.

Dr. D. B. St. John Roosa graduated from the University of New York in 1860, and at the outbreak of the war volunteered under the call of the President for 75,000 men, and was ordered in April, 1861, to join the Fifth Regiment, N. G. S., New York, as assistant surgeon, and served with it during its term of enlistment, three months. He reen-tered the service in June, 1863, for a period of thirty days, serving with the Second Regiment, N. G. S., New York, where he saw service in Pennsylvania.

Dr. H. D. Schmidt was born in Marburg, Prussia. After his graduation in the University of Pennsylvania in 1858, he devoted himself to histology and went South, and at the outbreak of the Civil War he entered the service of the army of the Confederacy, where he served throughout as surgeon, being the second of the original members who did so. At the close of the Civil War he returned to New Orleans, where he was made pathologist to the Charity Hospital, a position which he held for many years.

Dr. E. C. Seguin, the eleventh president of the Association, entered the service as a medical cadet in the Regular Army in 1862 when only 19 years of age. He served two terms in this capacity, the second time in 1863. In 1864, being 21 years old, he received his medical degree from the College of physicians and Surgeons in New York, and then accepted an appointment as acting assistant surgeon and served in Arkansas. Later he accepted a commission as assistant surgeon of the United States volunteers, and as such was mustered out of the service.

Dr. John Van Duyne was also in the Army. One of his old friends writes of him as follows:

During his cadetship he made an experiment on himself respecting the inoculability of the sloughs and discharges of hospital gangrene which prevailed so extensively in the hospitals of the Union Army. He sacrificed a fair sized area of one arm and covered the wound with a slough. Fortunately the wound healed without causing him any apparent harm. It would become an old man of that day to criticize that act fairly.

Dr. S. G. Webber, another of the surviving original members, entered the Navy on May 22, 1862, and served as surgeon until April 10, 1865. While Dr. Webber furnished me with many interesting details regarding the service of other early members of the Association, he with becoming modesty, refused to say anything about himself. He served with distinction for three years as surgeon in the Navy.

Dr. H. C. Wood, another of the surviving original members, saw some interesting service during the Civil War. After finishing his term as intern at the Pennsylvania Hospital, he entered the government service as contract surgeon, either the latter part of 1863 or early in 1864. His first assignment was in a base hospital in Philadelphia. He served there for three or four months, and was then transferred to a hospital in Washington. Here he remained only a few weeks.

Dr. Wood was then sent as second in command, under the late Dr. Harrison Allen, to a hospital immediately back of Grant's line during the "Campaign of the Wilderness," in the late spring of 1864. This hospital seems to have corresponded to what is now known as "evacuating hospitals." Part of his duties was to take charge of ambulance trains, carrying the wounded to base hospitals. During one of these trips he nearly lost his life through falling asleep on the roof of a car, having given up his berth to the wounded.

Shortly after the end of this campaign he quit the military service, and was appointed to the sanitary commission sent to Richmond. As a member of this commission he was among the first civilians to enter that city after its capture by the Union troops.

A number of the early members of the Association who joined after its formation also saw distinguished service. Among these was Dr. Daniel R. Brower; his record is as follows:

Commissioned by the President, assistant surgeon of volunteers, May 18, 1864. Appointed a captain of volunteers by Brevet, Oct. 28, 1865, "for faithful and meritorious service."

Mustered out by special order No. 581 War Department Adjutant General's Office, Nov. 5, 1865.

First service, U. S. General Hospital, Portsmouth, Va., March, 1864.

Second service, U. S. General Hospital, Hampton, Va., May, 1864.

Third service, U. S. General Hospital, Chesapeake, Va., fall of 1864.

Fourth service, chief medical officer, Military District of Norfolk, Va., spring and summer of 1865.

Fifth service, medical inspector of hospitals under Freedman's Bureau, fall of 1865.

Elected a member of the Military Order of the Loyal Legion of the United States, Chicago, Oct. 7, 1885.

Dr. S. V. Clevenger, who joined the Association in 1882, was the third of the early members of the Association who served in the southern army. He enlisted as a private, and was rapidly promoted

from artificer in the engineer corps to a first lieutenancy by Andrew Jackson, who at that time was governor of Tennessee. Later Dr. Clevenger was appointed to the command of Sherman Barracks in Nashville, a general recruiting rendezvous, which often contained from 3,000 to 5,000 troops. After the war he became a meteorologist in the U. S. Signal Service, and began the study of medicine under Army surgeons. In 1879, while in general practice in Chicago, he turned his attention to the specialty of insanity and nervous diseases, in which he did notable work.

Dr. Charles K. Mills, who became a member of the American Neurological Association in 1881, and its president in 1886, was too young at the time of the Civil War to serve in the Medical Corps, not receiving his degree of doctor of medicine until 1869. In 1862, when he was between 16 and 17 years of age, he served as a private in one of the régiments, the Eighth, P. V. M., known as the blue reserves, called out for the defense of the state at the time of the first attempt of the invasion of the North by Gen. Robert E. Lee. In 1863, when Lee again attempted the invasion of the North and succeeded in entering Pennsylvania with 80,000 men, the village company of which Dr. Mills was a member was one of the first to respond to the emergency call of the President and of the governor of the state, and again went to the front in the old regiment which was this year known officially as the Thirty-Third, P. V. M. Dr. Mills was first corporal of this company. The regiment served during the entire Gettysburg campaign. On the first day of the Gettysburg battle, the brigade of which it was a part came in contact with a force of cavalry and light artillery in Carlisle, Pa., and an engagement occurred which was an outlying part of the first day's battle. On July 13, the regiment took part with a detachment of cavalry of Gen. Judson Kilpatrick's division, the combined force being under the command of Gen. George E. Custer, in an engagement between Hagerstown and Williamsport. The regiment was commended for its excellent conduct in this engagement in a general order of the Commander-in-Chief of the Army of the Potomac, General Meade.

Dr. Wharton Sinkler, the thirteenth president of the Association, became a member in 1881. During the Civil War he served in the ranks of the Second South Carolina Cavalry. He was at that time 17 or 18 years of age, and served as a private.

Dr. Burt G. Wilder, the sixth president of the Association, became a member in 1882. He was made a medical cadet in 1862, serving in this capacity during that year and in 1863, being on duty in a general hospital in Judiciary Square, Washington, D. C., where now stands the Pension Building. After this Dr. Wilder was placed on duty with Dr.

John H. Brinton, Philadelphia, who was then engaged on writing the surgical history of the Civil War. He was then made an acting assistant surgeon, although he had not as yet graduated in medicine. Dr. Wilder then obtained a discharge as a medical cadet, passed the examination as licentiate of one of Massachusetts' medical societies, and was appointed assistant surgeon and served with the Fifty-Fifth Massachusetts Volunteer Infantry, the second colored infantry from that state, and later was made full surgeon and served throughout the war.

Dr. Wilder's work in comparative anatomy and zoology is, of course, well known. He was appointed to the original faculty of Cornell University, where he served for forty-two years as professor of neurology and vertebral zoology, and was made emeritus professor in 1910.

In the Spanish and Philippine wars two members saw active service. Dr. S. P. Kramer held a commission as major and brigade surgeon, and was in command of military hospitals in Havana and Montauk Point. Dr. T. H. Weisenburg was made an acting assistant surgeon in 1901, and served in that capacity in the Philippine Islands during the years 1901 and 1902.

THE TREATMENT OF WAR NEUROSES *

SIR JAMES PURVES STEWART, K.C.M.G., C.B., M.D., F.R.C.P.

Senior Physician to the Westminster Hospital; late Consulting
Physician to H. M. Forces

LONDON

The following general maxims make no special claim to originality. They are offered, however, as a representation of the experience of the past four years of war, by one who has had the privilege of watching, in England, Malta, Gallipoli, Macedonia and Egypt, the successes and failures of various methods of treatment, both in his own hands and in those of his fellow medical officers.

The writer asks the kindly indulgence of the skilled neurologist. To such a reader, many of the remarks will appear not merely commonplace, but almost childlike in their simplicity. It may be, however, that some less expert reader will find hints of practical usefulness, when brought face to face with the class of cases here referred to.

If our treatment is to be successful, an accurate diagnosis is of fundamental importance. And therefore, before entering on any course of treatment in a case of war-neurosis, the first essential is to obtain as clear a conception as possible of the exact condition with which we have to deal.

COMPLETE HISTORY OF GREAT VALUE

We begin by making a careful *study of the patient*. We inquire not only into his present symptoms, but particularly also as to the time and mode of onset of each of these. No detail, however trivial, should be ignored. The patient should be encouraged to tell his story at some length. If, during the process, he tends to become too long-winded, we must be careful not to betray any impatience or want of interest. The patient will feel dissatisfied if he thinks he has omitted any detail of his history. If time is becoming short, it is better to break off the consultation and to resume it again at a subsequent occasion, rather than let the patient have the feeling that he has left anything unsaid. By tactful questioning we supplement, correct and coordinate the information which the patient offers us. We should be specially careful never to give the patient the impression that we are skeptical as to the accuracy of his statements. When we have reason to suspect him of exaggerating his symptoms, or even of fabricating "decorative" details,

* Submitted for publication Oct. 30, 1918.

we must not let him see that we doubt his veracity. Throughout the interview we try to form a judgment as to his degree of intelligence and culture, and also as to his habitual emotional reactions. A patient of low-grade mentality will require to be handled, as regards curative suggestions, differently from a more intellectual patient.

In addition to the history of the patient's present illness, his previous career and his family history should also be inquired into. These are points which sometimes tend to be overlooked by the inexperienced practitioner, who thinks that, if he secures a straightforward account, say, of a shell explosion, followed by certain functional symptoms, this is enough, and that he can proceed right away with a course of treatment. This is a great mistake, for, as a matter of fact, the patient's in-born hereditary tendencies, his previous career and health, his peace-time environment and his reaction to that environment, all have a profound, and sometimes a decisive, influence in determining the manner in which he subsequently responds to the more dramatic incidents of war. First of all, then, we obtain a clear, accurate and complete history.

SYSTEMATIC PHYSICAL STUDY REQUIRED

We next proceed to a methodical physical examination of the patient. This should never be omitted, even in cases which, from the outset, appear to be perfectly simple and straightforward. By following an invariable rule of systematic physical examination, not only do we guard against the unwisdom of accepting and, so to speak, swallowing predigested, some one else's diagnosis (which may be correct, or otherwise), but the mere process of thorough personal investigation has a beneficial suggestive effect on the patient. If we employ a well-designed routine method of investigation, this part of the examination in a case of neurosis takes up only a comparatively short time. But, now and then, it reveals new, unexpected and important clinical facts, perhaps unnoticed by the patient (for example, a hemianopia, or an extensor plantar reflex), which would otherwise have escaped observation, but which may profoundly modify our original diagnosis. A hasty or slipshod examination is always bad. It is bad for the physician, who may thereby fail to grasp some essential point of the case. It is also bad for the patient, if he thinks that the physician is not sufficiently interested in his case; moreover, it diminishes his confidence in the ability of the physician to cure his symptoms.

The interview between patient and physician should leave on the patient's mind the true and sincere impression that the patient, his symptoms, history, and treatment, are the only things in which the physician takes any interest, and that, for the time being, the physi-

cian's whole personality is being focussed on the patient, to the exclusion of everything else in the whole wide world. This ought not to be a matter of pretense or "bluff." The physician, for the time, *should* focus his whole attention on the particular patient before him. Whilst the patient William Smith is in front of him, he has no business to be thinking about the symptoms of Tom Jones who preceded him, nor about James Robinson who may be waiting to see him next. But, the moment William Smith's case is completed, and a few necessary memoranda made about it, the physician should now wipe William Smith clean out of his mind, and focus with equal concentration on James Robinson, from the very moment when Robinson comes in. This faculty of rapid and exclusive concentration on each successive case is one which can only be fully developed by practice. It constitutes one of the most valuable assets in successful diagnosis and treatment.

PERSONALITY OF THE PHYSICIAN

This is an all-important factor for successful treatment. This is no mere platitude. Neuroses, above all other diseases, are those in which one physician habitually succeeds, while another, of equal professional training and knowledge, habitually fails to obtain such good results. The successful physician (I mean the physician who succeeds, not in extracting fees, but in curing his patients) besides possessing a sound knowledge of his subject, must have a justifiable confidence in himself and in his own particular methods of treatment. This confidence he communicates to his patient, not only by words, but by his whole personality, thereby creating an atmosphere of curative suggestion. The physician should exercise authority over his patients, firmly, quietly and with imperturbable good temper. A medical man whose manners are pompous, over-bearing, blustering, or bullying, may succeed in curing a certain small proportion of cases, but these are chiefly among patients of inferior intelligence. I disapprove entirely of employing anything in the form of roughness or painful physical stimulation (practically equivalent to punishment) as a routine vehicle of curative suggestions, although measures of this sort have been carried out and with some success, chiefly in Germany, constituting Kaufmann's so-called *Ueberrumpelung*, or hustling treatment. In this, the patient, previously stripped, is subjected to intense and prolonged faradization or sinusoidal currents (being held down by several assistants, if necessary). This is combined with stern military discipline by the medical officer who "commands" the patient to move the paralyzed limb or to stop a hysterical tremor, the séance lasting, if necessary, for hours, until the hysterical symptom shows signs of yielding. This "curative" séance is followed by a night's sound sleep,

aided by a strong sedative draught. Next day gymnastic exercises are resumed, without electricity, but under the same medical officer who "cured" the patient. This kind of treatment is rarely necessary, and should be reserved for exceptionally chronic and resistant cases. Equally good results are obtainable by kindlier methods, and any feeling of antagonism between the patient and his physician is usually a serious handicap to successful treatment.

At the very outset, the physician should endeavor to secure not only the patient's confidence, but his good-will. Unless the patient is malingering, this ought not to be difficult. We should aim at securing the patient's cooperation in his own cure. As a matter of practice, it is useful, after our careful preliminary examination, to begin by explaining our diagnosis to the patient in simple, nontechnical language, and then to ask him frankly whether he will try and help in his own cure. The patient must be encouraged to feel that we are treating not an abstract disease, but a sick man with an individuality of his own. The first interview between patient and physician may thus be far-reaching and even decisive in its effects, and no effort on the part of the physician should be spared to gain an immediate tactical advantage at the outset of the campaign which is about to follow.

ENVIRONMENT OF GREAT IMPORTANCE

The environment in which treatment of neurotic patients is to be carried out should be carefully selected. That the patient should be withdrawn from the original surroundings under which his symptoms first developed, goes without saying. At the earliest possible moment he should be placed under the care of a trained neurologic physician, preferably in a specially arranged hospital. This should possess a specially skilled staff of medical officers, orderlies and nurses, so that curative suggestions can be concentrated on the patient as soon as possible. By this means, many a soldier who has had an emotional shock, is prevented from developing nervous symptoms, while any symptoms which may have already appeared are "nipped in the bud," and he shortly becomes able to return to his duty.

Segregation of early cases, each patient having a special tent or room to himself, away from other patients, is of special value. The patient, however, must be made to feel that he is not being imprisoned, but that he has been selected for special individual care for a limited period of time, and that meanwhile he is under constant observation by the physician, or by his skilled assistants or nurses. He is thus isolated for a time, not only from other patients, but also from well-meaning but injudicious relatives or friends, whose harmful suggestions play so important a part in the production of hysterical symptoms.

An atmosphere of cheerful, mutual confidence and optimism is essential. This should be created, as already indicated, at the first

interview between patient and physician, and must be carefully maintained. Any physical discomforts which are complained of, such as headache or sleeplessness, are to be promptly attacked by appropriate measures.

The earlier a patient comes under skilled treatment of this sort, the better are his prospects of cure. The confirmed neurotic, or "hospital-bird," who has wandered from one institution to another, gathering pearls of clinical symptomatology by the way, or, in other words, learning new tricks, is much more refractory to treatment than the recent patient who has not yet been examined or treated. The "hospital bird" tends also to have a considerable superadded element of malingering, which helps him to play his part with added gusto, whether to bored or to sympathetic audiences.

How long should the neurotic patient be isolated from his fellows? The answer is, until he shows definite signs of commencing recovery. No hard-and-fast rule can be laid down. In mild cases, two or three days may be enough; in others, several weeks. Each case must be considered on its own merits. If we have a ward in which a number of convalescent neurotics are completing their cure, there is a stage of improvement at which it becomes advantageous for the patient to be released from his primary isolation, so as to have the curative suggestions reinforced by the society of other patients who are farther advanced on the road to recovery. This is toward the later stages of his cure. To congregate together a number of neurotic patients who are not improving, is bad for every one of them. And even when we are handling large numbers of patients in a hospital ward, the individual must never be lost sight of. Conversations between the patient and the physician are occasionally overheard by a neighboring patient. The skilful physician sometimes takes advantage of this to drop a Parthian shot in the form of a well-directed suggestion adapted to a patient other than the one whom he is directly addressing. And in this connection, we must be careful never to do or say anything to humiliate a patient in the presence of his fellow patients. Therefore, when conditions are such as to necessitate the treatment of a number of patients in a common ward, not only should there always be a tactful nurse, or nurses, constantly on duty to supervise treatment and maintain discipline, but a special side-room should be arranged in which private interviews with the physician can take place.

AFTER-TREATMENT AND SUPERVISION IMPORTANT

The return of the patient to his own home should, as a rule, be postponed until the cure is practically complete. Visits by the patient's relatives or friends, restricted to a few minutes' duration, should be

cut down to the minimum, and in most cases, after a single first meeting, should be forbidden, until a certain degree of improvement has been attained. Correspondence should also be discouraged. The patient should be reassured by the promise that any urgent home facts will be duly communicated to him, not directly but through the physician. Even when, at a later stage, visitors are allowed, each friend or relative should be scrupulously warned as to the importance of the atmosphere of encouragement, and should only be admitted to visit the patient on the clear understanding that such an atmosphere will be maintained.

The foregoing maxims are not applicable indiscriminately to every case of neurosis. Symptoms which have been produced mainly by emotional shock or by suggestion are to be treated chiefly by psychical methods; those due to physical concussion or to exhaustion chiefly by physical remedies, such as rest, massage, diet, electricity, etc. Those due to intoxications are the cases in which drugs are most likely to be of value in combating individual symptoms, such as tachycardia, insomnia, etc. Other cases may require to be transferred for treatment to a mental hospital. Hence the importance at the very outset of the careful diagnosis and accurate classification of each patient.

During his entire course of hospital treatment the patient's time must be suitably occupied. For the first few days at least, absolute rest in bed is usually advisable. Then follows a careful program of rest, recreation and work, in due proportion, planned from day to day. Exercise, whether physical or mental, should always stop short of producing exhaustion. Aimless loafing around a hospital ward, "waiting to get well," is sheer waste of time, and tends to encourage professional invalidism. Each patient, after an appropriate interval, should be made to understand that certain duties are expected of him. For a less active patient these duties may consist in assisting in the arrangement and tidying of his room and ward; later, he should be allotted some form of work which has the charm of novelty. Outdoor occupations are usually preferable, for example, gardening and various forms of farm work. Suitable games and amusements, preferably in the open air, are also added to the program. All these are best organized by a resident medical officer, rather than by a visiting physician; an ideal man for such a post should possess the qualities of the genial Father O'Flynn of "ould Donegal":

'An' yet for all ye're so gentle a soul
'Sure, ye keep all yer flock in the grandest control.
Checkin' the crazy ones, coaxin' un-aisy ones,
Liftin' the lazy ones on wid yer stick!

SPECIAL TREATMENT OF INDIVIDUAL SYNDROMES

In each case of hysteria, after careful examination and secure establishment of the diagnosis, a careful plan of treatment is to be selected for that case. The tactics of this campaign, which should be "short, sharp and decisive," will vary with each individual case, according to the patient's mentality and according to his special symptoms, for example, paralysis, contracture, tremor, etc.

The hysterical symptom was originally induced by suggestion, whether from the patient himself or from outsiders, and it has now to be removed by counter-suggestion on the part of the physician and his staff. We begin by confidently assuring the patient that he is curable, and ask him frankly whether he is willing to get well. We then promise him that his cure will begin at our very next interview. If this cannot take place immediately, it is often prudent, while awaiting the crucial moment, to isolate the patient in a room by himself, for not more than a day or two, leaving the recollection of the first interview with its careful examination and promise of cure, to incubate in his mind. In the meantime, during this preliminary period of expectation, his sleep and general bodily functions must be carefully attended to.

After this short preliminary period of isolation and expectation — a period which in favorable cases may be omitted, especially in patients of higher grade mentality — we proceed to the crucial interview of curative counter-suggestion. This interview, which should not take place in the presence of other patients, but in a special room for the purpose, must never be allowed to end without achieving some visible improvement, demonstrated to the patient himself.

Some cases yield rapidly to counter-suggestions, others may require an hour or more. For the curative interview no hard and fast rules can be laid down. It is essentially a contest between the physician's personality and that of the hysterical patient. Each physician must wield his own personality in his own way, varying his weapons in different cases, according to the problem he has to attack. A highly intelligent patient requires more dexterous explanations than a man of coarser fiber. Delicate rapier-thrusts are lost on a rhinoceros-like mentality and we often have to supplement our explanation by an appeal to the patient's imagination, say, by electrical stimulation, which to most laymen is unfamiliar.

If the patient is suffering, say, from hysterical paralysis of a limb, the physician will explain to him in clear, nontechnical language how the weakness has been produced by undue concentration of the patient's mind on this particular limb, which, perhaps, had originally

been the site of some injury. He will show him that the apparent paralysis is not due to any real want of power, either in the muscles or nerves. This part of the explanation is usefully supplemented by brisk faradic stimulation of the affected muscles, thereby demonstrating to the patient that they really can move it. It may be further explained to the patient that, owing to his emotional shock, his brain has temporarily got out of the habit of using the affected nerves and muscles, but that now he realizes that the muscles can and do contract, for example, under the influence of faradism; his own will-power, directed to the same muscles, will also produce the same effect. We therefore "encourage" him to move the paralyzed limb, aiding him at first by faradic stimulation applied to the "motor points." Presently, when he begins to perform voluntary movements, we continue our stimulation, but no longer on the motor points, until finally we are able to demonstrate to the patient that he is performing the movements altogether independently of our electrical stimulation. Often a single interview of this sort, with energetic stimulation, is enough to restore completely the motor power which the patient had believed to be lost.

In cases of hysterical contracture, which not uncommonly accompany hysterical paralysis, during our process of explaining his case to the patient, we passively move freely the contracted joint or joints. Any adhesions which may be present are thereby broken down and the stiffened muscles are stretched and rendered more supple. Passive movements are then supplemented by electrical stimulation of the muscles, and the patient is encouraged to cooperate by voluntary efforts. In this way the patient, who has often become somewhat confused by our various manipulations and by the series of tests applied to the affected part, tends subconsciously to perform some movement of the paralyzed limb. This is the moment to be on the look-out for. As soon as we see the slightest voluntary movement, we pounce on it, call the patient's attention to its presence and show him that he has now ceased to be paralyzed. In his confusion and excitement he repeats the movement, and continues to perform it with increasing power, aided at first by electrical stimulation, until at last he can execute spontaneously all the movements which at first were only carried out passively by the physician.

Hysterical tremor, like hysterical contracture, with which it is often combined, is best treated by repeated passive movements of the affected limb, lasting half an hour, an hour, or longer, accompanied by verbal suggestions, until the muscles have become relaxed. We then encourage the patient to perform active voluntary movements, free from tremor or rigidity.

In hysterical paraplegia of contracted type, we first of all remove the muscular rigidity, and tremor if any, by passive movements and verbal suggestions to the recumbent patient. He is then encouraged to supplement the passive movements by active cooperation and later to perform them unaided. After a rest, these passive and active movements are continued with the patient sitting up. Then, after another short pause, he is persuaded to stand and walk, at first with help and finally unsupported.

Similarly in a case of flaccid hysterical paraplegia, we lift the apparently helpless patient to his feet, supporting him on both sides. We now proceed to march him up and down. Usually the patient makes some sort of feeble movement of the legs to balance himself. We watch for this first movement and point it out at once to the patient, telling him that his *curé* has begun. We then hustle him up and down, encouraging him all the while, and aiding him by electrical stimulation to the spine and lower limbs, until he can finally stand and walk alone.

It is of great importance to persevere with our curative *séance* until cure is complete, rather than break off with only a partial cure. And in any case, we must never conclude our curative interview without achieving a definite improvement which is visible to the patient himself and to his entourage.

Special splints or supports, which have sometimes been employed for the correction of hysterical paralyzes and contractures, should be avoided altogether in hysteria. Not only are they unnecessary, but they are positively harmful, since they tend to perpetuate in the patient's mind the suggestion of disability. It should also be borne in mind that splints and other apparatus, originally applied for the maintenance of correct posture in a limb which has some *bona fide* organic lesion of nerves or other structures, may subsequently come to exercise a baneful suggestive effect, so that by the time the surgical injury is healed, the patient has lost the habit of using his muscles. In other words, a hysterical paralysis has become superimposed on an organic injury. In these cases the supporting apparatus is now a hindrance to complete recovery and the patient will carry about his crutch or splint indefinitely, until by counter-suggestion and reeducation, he learns that it is useless. He then discards it, whether on the floor of the physician's consulting room or on the wall of some patron saint's chapel, as the case may be. The importance of motor reeducation in organic injuries is appreciated by every medical officer who has had the opportunity of watching the beneficial results attained in the "curative workshops" attached to our military orthopedic hospital centers.

HYPNOTIC SUGGESTIONS

Hypnotism is rarely necessary and has been discarded by most neurologists. It is open to the objection that the phenomena of the hypnotic trance are themselves essentially hysterical in character, so that by hypnotizing a hysterical patient we are merely replacing one hysterical condition by another. To this it may be answered that it is better for a patient to be hypnotically capable of movement than hysterically paralyzed. As a matter of clinical experience, however, we find that waking suggestions are just as efficacious as those achieved by hypnosis, and their effects are more likely to be permanent.

In cases of obstinate motor disability, and in hysterical mutism, it is sometimes advantageous to give the patient a general anesthetic, to the extent of producing a transient mental confusion. During this stage of intoxication the patient often begins to talk or moves energetically his previously paralyzed limb. As he comes around from the anesthetic, we continue to talk briskly to him and make him go on moving the limb, until, when he finally wakes up to full consciousness, he finds himself carrying out free voluntary movements which were previously impossible. Hysterical deafness is often similarly cured by a general anesthetic, associated with vigorous conversation with the patient as he is coming round, perhaps combined with a touch behind the pinna with a hot Paquelin cautery, so as to concentrate his attention on the affected ear. Hysterical stammering is more difficult to cure than mutism. A considerable proportion of cases give a history of stammering in childhood. To eradicate it, prolonged treatment may be necessary, since the stammer in such patients is merely one of the stigmata of a congenital psychasthenia. Hysterical blindness is often cured by the familiar device of placing a plane lens in front of the alleged blind eye and a strong *plus* lens in front of the good eye, so strong that the patient cannot possibly see through it; or we may drop a mydriatic such as homatropin into the sound eye. We then ask the patient to read. He succeeds in doing so, unconscious of the fact that he is now reading with his supposed blind eye. Once he realizes this fact, cure rapidly ensues.

TREATMENT OF OTHER NEUROSES

Neurathesia, or simple nerve exhaustion, with its excessive fatigue on exertion, be it physical or mental, and its other clinical phenomena, cannot be relieved by suggestion alone, although encouraging suggestions will hasten the process of convalescence. For the treatment of neurasthenia we prescribe rest in bed for a month or longer, combined, in severe cases, with isolation, and in all cases with an abundant diet and with general massage, just as in the ordinary "rest cure" of peace

time. Later on, graduated open-air exercises are added. As a rule, six weeks or longer must be devoted to the cure, if we hope to secure permanent results. Neurasthenic patients of lower grade mentality or of neuropathic heredity are less satisfactory as regards results of treatment than the intelligent patient, free from hereditary taint, and are usually unfit for further military service, except at the base.

Dysthyroidism, with its tachycardia, relative lymphocytosis, etc., may occur either as a pure clinical picture, or it may be complicated by neurasthenic symptoms. But even those patients with well-marked tachycardia progress favorably under graduated open-air exercises under an intelligent instructor and, in time, become fit for ordinary exertion. They tend, however, to remain permanently hypersensitive to emotional stimuli.

Anxiety-neuroses following incidents of war require careful study, with analysis of each individual case. They are best treated by isolation, rest in bed, attention to sleep, psychical analysis (not in the narrow freudian sense) and by encouraging suggestions and reeducation for the stress of every-day life. In such patients analysis of the mental content, inclusive sometimes of dream-analysis, may require long and patient conversations, in which various threads of association in the patient's mind are followed up. Such analyses often have their beneficial effect not merely owing to the "mental katharsis" on which the freudian school lays so much stress, but still more from the self-knowledge which the patient thus attains, a self-knowledge which brings with it self-control.

In all war-neuroses, an atmosphere of confidence and cheerfulness on the part of the medical officer and his staff exercises a profound and beneficial influence on the patient. This is effected not merely by the conscious suggestions imprinted on the patient, but by the development of a happy, "emotional" feeling-tone, entirely reflex and subconscious, exercised through the vegetative nervous system and the endocrine glands.

94 Harley Street, W.I., London.

WAR NEUROSES

SOME VIEWS ON DIAGNOSIS AND TREATMENT *

COLIN K. RUSSEL, M.B.

Lieutenant-Colonel, C. A. M. C., Consultant in Neurology and Psychiatry

MONTREAL, CAN.

One effect of the war on the medical profession has been to greatly enhance the importance of two special lines of work: (1) orthopedic surgery, and (2) neuropsychiatry.

In prewar days, one might say that these specialties were fighting for proper recognition. Now in England and Canada, at least, military orthopedic surgery includes practically everything but lesions of the brain and the viscera of the abdomen and chest, and the great majority of surgical cases in a military hospital at the base are now looked after by the military orthopedic surgeon.

In the realm of internal medicine and not including the definitely insane, the proportion of returned casualties is about equally divided between the neurologist and the internist. This is due to the fact that we are now beginning to appreciate that the mind is a function of the brain, just as digestion is a function of the stomach and intestines, and as such, deserves at least an equal amount of recognition and study.

FACTORS INVOLVED IN CLASSIFYING THIS WORK

There are several factors that have, up to the present, prevented this fact from being generally recognized in practice:

1. The intangibility of the symptoms of any disorder of the mind.
2. Their frequent and apparent dependence on organic diseases of other parts of the body.
3. Mental specialists, the psychologists, have too often been men insufficiently or not at all experienced in the practical part of medicine and given to express their ideas in obscure phrases, telling us things we all know quite well, but in terms we cannot understand.

There is a fourth reason which is probably more important than any of these: All departments of medicine have struggled through

* Submitted for publication Nov. 27, 1918.

* Read at the Annual Meeting of the American Neurological Association, Atlantic City, N. J., May, 1918.

all these obstacles which I have mentioned, to the light. The symptoms of heart disease were intangible enough, I have no doubt, until Harvey and his successors by hard, common sense work have lifted the veil. Symptoms referable to any system may be caused by lesions of other organs often far removed, and again in the days not so long passed when the theory of humors was in vogue, certainly there was obscurity enough of phraseology which then, as now, betokened simply the uncertain knowledge.

4. The fourth reason against our more rapid advance in the recognition of psychogenetic (born in the mind) disorders is the natural tendency to play safe. There has been reason for this in the past, but in the present stage of development of the art of medicine, with specialists in all hospital departments where all may come for observation, study and treatment, there is no longer any such excuse. In the meantime, the "raison d'être" has been given for the formation of numerous sects of irregular practitioners, who in turn unquestionably retard the progress of our search after scientific truth.

Our understanding of such functional conditions has been helped by the war because in the great majority of cases, this disturbing idea is, of course, obvious, whereas in the intricacies and unseen influences of civilian life, the disturbing ideas are often complex and obscure.

SHELL SHOCK

In considering this functional or psychogenetic condition in soldiers, I refer to the condition particularly which has come to be known as "shell shock," a term which should not be used but which just naturally catches the imagination of the uninitiated so that it is difficult to eradicate it. In dealing with such cases, it is obviously of primary importance to exclude the presence of organic disease as a cause of the disability complained of, and especially does this apply to the nervous system. Too often the average practitioner has forgotten all he ever learned of this system which, in the army on active service, is more important than most others.

You must be able, also, to exclude any organic disease of the nervous system. You must realize that the mind may be the seat of origin of the disability and you must realize that an individual can be made to change his mind.

Let me now recount a few typical cases of psychogenetic conditions, discussing them briefly as we go along. We will then try to work out a general understanding of their etiology and method of development with an explanation of the treatment.

REPORT OF CASES

CASE 1.—Private S., was admitted to special hospital in England with complete paralysis of both legs; duration six months. Examination showed some impaired movement at the hip joint; practically no power of movement at the knees and absolutely none at the ankles or toes. A slight degree of general wasting below the knees particularly; loss of sensibility of the stocking type reaching to both knees. A pin could be pushed through the calf of the leg without being felt and no bleeding followed, although this operation was repeated several times. Reflexes were normal and the muscles reacted normally to the faradic current. Evidently a straight hysterical condition. This boy had never been to France, but came from what he called a "fighting family." All his brothers had enlisted before he had. He was not a robust type; not given to athletics. He stated that he had paid \$150 to have his teeth set right so that he would be accepted in the army. He married in England without obtaining the consent of his officer commanding, so that there naturally was considerable delay in obtaining separation allowance. In the meantime, his wife became pregnant in England where she had no friends or relatives. Without their separation allowance, in his absence, she would only have what money he could assign to her from his pay to live on. Naturally, his desire was not to leave her. During a long route march, with full winter equipment, he had to drop out on account of his feet and on reporting to his medical officer, who it happened was not the regular medical officer of the battalion, but somebody doing his duty, he was told that he had weak feet and ankles, that they would always be a source of trouble to him. He was taken off duty but not sent to hospital. Lying around the cold huts, one can easily imagine that the pain and stiffness in his feet were not improved. In the presence of his desires and his natural lack of robustness, the seed sown by the medical man fell on fertile soil. His feet and ankles very soon became paralyzed and this spread to his knees and he was admitted to hospital where he remained six months before being sent to the special hospital. He was carried from his ward down half a dozen steps to my examining room and, after my examination, I explained to him the origin of his trouble, and the fact that it could be controlled, and in one-half hour that boy went back to his ward, up those stairs walking perfectly. He had regained complete sensibility in the legs, and now each time he was merely touched with the pinpoint, it bled naturally. He was given duty in the hospital in the quartermaster's department and carried on perfectly efficiently.

I can quote another case as similar:

CASE 2.—The patient had paralysis of both legs which had lasted eighteen months, and in which the man had been carried around on a stretcher from one hospital to another, who in the course of one hour after my examination, was walking perfectly. He had similar loss of sensibility and similarly a pin thrust did not bleed nor show any tendency to an infective reaction. His disability originated after being buried and struck on the back with some debris.

I will quote, also, a third case:

CASE 3.—A soldier in the Imperial army had received a bullet wound through the arm in the retreat from Mons, twenty-two months previous to my seeing him. In the meantime, he had been discharged from the army with a paralyzed arm and had received a pension for one year from the British government. On coming up to have his pension renewed, he was referred to me for further treatment. Within fifteen minutes, he was using his arm as well as he ever did.

CHARACTER OF THESE CASES

These cases which have been quoted represent types of genuine hysterical disabilities, but the term psychogenetic is used for practical purposes to cover cases which hardly come in this category. In practice, it is impossible in many cases to differentiate between genuine hysteria and malingering. For instance, take the case of the private who is admitted to my ward in a hospital in France with the diagnosis of epilepsy.

CASE 4.—We received orders, the day following the entrance of this private, to empty the hospital in preparation for new cases. I sent this patient to the convalescent camp, thinking he could be observed there. In the course of a week, he was returned with a note to say that he had two attacks and was in status epilepticus, and that they could not keep him. I camped in the ward with that boy until he had another attack (fortunately, I did not have to wait long), and I saw that it was not idiopathic epilepsy, but a psychogenetic condition.

His story was as follows: He had been at the front for twelve months since the days of the German retreat and had had no leave. He felt that it was due to him. Moreover, he showed me a letter from his sister stating that his brother had been severely wounded and it was a question whether his leg could be saved. His aged mother had taken it very badly and was very ill and praying for his return. He stated that when he thought of all this, he felt so badly and he just seemed to get worse and worse until he had an attack. He thought he could control them. It was explained to him that the army authorities tried to be just, and that if he had been at the front for twelve months without leave, it was certainly due him, but he must realize that to behave in such a manner was really doing the only essential part of himself a greater hurt than the enemy could possibly do him; that if he would control himself, I would send him to the base with the recommendation for leave. He was kept some ten days in the hospital and the change in him was remarkable. He was bright, active and cheerful around the place, and had no more attacks.

Is the foregoing case to be classed as one of hysteria or malingering?

OTHER CASES OF INTEREST

CASE 5.—Private R. was admitted to the special hospital in England on crutches. He was completely paralyzed in his right leg, partially in his left. Since using crutches, he had developed paralysis of his right arm. There was very marked vasomotor changes in the right leg and arm with loss of sensibility. Examination showed no evidence of organic disease and he was told there was no reason why he could not move his limbs perfectly. He stated that he had tried to, not any longer ago than that morning when alone, but could not move them. He was, however, soon persuaded to use his arm and walk perfectly, and he has done so ever since; in fact, I noticed a short time ago that he had received a commission.

His story was this: While in the trenches, he had an attack of sharp pain in the right knee. He volunteered the statement that he had not used his leg as much as he might have and it gradually became more and more useless, and then his left leg became affected. When he began to use crutches, he developed crutch paralysis in the right arm. He had been paralyzed some three months. He said the reason for not using his leg was not on his own account, but on

account of his mother at home. Since enlistment, his father had died and his two brothers had enlisted, his mother was left alone and he wanted to get home to her. He seemed really grateful for his cure. Apparently here we have a case of hysteria developing on a basis of malingering.

CASE 6.—Private McK. was admitted to this special hospital in England complaining of complete blindness, paralysis of the left arm and weakness of the right leg; duration six months following being buried. He came to me after having been in the National Hospital, Queens Square, London. On examination he had complete loss of sensibility in the left arm. After examining him, and finding that his condition was psychogenetic, I expressed my surprise that he had been turned out of that hospital in that condition, knowing the type of work that is done there. I naturally inquired what medical officer had seen him and stated my intention to inquire into the matter. This I imagine worried him for, in the middle of my explanation to him of his condition and the cause of it, with a great cry he suddenly recovered his eyesight and his power in his arm and leg. We had many rapid cures, but this was too rapid to be convincing. He told me he was a medical student at Johns Hopkins Hospital and stated he had been eighteen months in the front line. I did not inquire further into his medical studies, but realizing that he was not suitable at present for front line work, I had him attached to the hospital as an orderly. Some doubts were thrown on his statement when he said that he had taken an arts course before he had studied medicine, and on being asked what branch of study he had taken up in this course, he replied, "Music and painting." It was superficially noted, also, that for a student of Johns Hopkins Medical School, his technical knowledge was rather weird. However, from a military point of view, this did not interest us.

Some two weeks later, after his affectionate advances had been turned down by their object, he came to my examining room again completely blind. I was not altogether surprised as I had been consulted by the mother of the lady in question and knew the inside history of the case. His own story given to me was a tissue of lies. Added to this, he was already married. When threatened with court-martial, he recovered his eyesight very promptly and was returned to general service in France. This was a year and a half ago, and I heard nothing more of him until a month ago when, on a trip of inspection in Halifax, I met him again. This time he had paralysis of the arm. He had told the same story of being a medical student at Johns Hopkins Hospital, whereas in reality, he worked in a garage in Boston before the war. He now stated his disability was due to being sprinkled on the left shoulder by pieces of shrapnel. He had multiple small scars, but close examination showed that they were all over his shoulders and back, and were due to a severe acne.

Examination of the arm showed no organic lesions. He stated that he had been nine months at the front after I had discharged him to duty, and admitted he had not been wounded, but could not give any reason for the paralysis of his arm except that it was a recurrence of the old condition. He had again lost complete sensibility in his arm, and pin thrust through the arm did not bleed. He was given strong electricity with the idea of giving him an excuse for recovering, but this made no impression. I then saw him alone, warned him that I would give him two minutes to use his arm, in which case he would be discharged without pension or if he did not, he would be court-martialed. He knew that I knew his whole story and could judge how it would appeal to a jury at a court-martial. The result was that he moved his arm perfectly and just as well as the other in the stated time. Following this, examination

showed that whereas a few minutes before a pin thrust was not felt and would not bleed, now the slightest pinpoint was felt and bled naturally. As far as I can see, the only factor to account for this was a purely mental one which consisted in influencing him to change his mind and make his intellect govern his desires.

GENERAL CONSIDERATIONS REGARDING SHELL SHOCK

Let us consider now some points of general interest in the study of this so-called "shell shock."

(a) During a period of six or seven months when in charge of the neurologic ward of a general hospital at the base in France, where I saw most of the cases of neurologic interest in the surgical wards as well, I never saw the symptoms of shell shock in a wounded patient. Later when in England in charge of the medical side of a special neurologic and orthopedic hospital, I did see a few such cases, but they were always in cases when the wound had been rather slight, and should not have been sufficient to have made it necessary to send the man back to England by itself, or in patients who had recovered from a wound, and when there was a question of them returning to France again, the symptoms of shell shock developed.

(b) We do not find shell shock in our German prisoners; the Germans report there is no "grenade fever" among the prisoners whom they have taken. These men have been exposed to the same effects of shell explosion as men who have not been taken prisoner.

Some observers have advocated the view that there is a definite organic basis underlying shell shock and have imagined a condition of diaschisis where the terminal dendrites of one neuron have been as it were shaken loose from the associated cells so as to make a break or disturbance in the connections in the association tracts, but it is interesting to notice severe wounds of the brain without the slightest evidence of disturbance of the mental mechanism — evidently, then, it is not an organic lesion.

(c) I made a detailed study of some sixty cases of psychogenetic conditions picked at random from the files, and these showed that the average time in France for the whole of this series was two years and eight months, but if we exclude eight of these cases who did spend a considerable time at the front before breaking down, the average time for the rest is reduced to one year and nine months. Nine had never been there at all.

Evidently, the only common experience in all these cases was that they were exposed to danger or under the apprehension of being exposed, and the explanation of shell shock not being found in prisoners, either our own or those of our enemies, is that they were no longer exposed to such danger or were not under the apprehension of it.

PRIMITIVE INSTINCTS OF MAN

To understand the full meaning of this, we must go back to the primitive beginnings and consider the primitive instincts. We must first appreciate the fact that an instinct is primitive innate tendency. There are two essentially primitive instincts; the instinct of self-preservation, and the instinct of procreation. These are primitive; they must have been present in the early beginnings of animal life. Their absence in an individual would certainly have assured that he would not be represented in the present generation. These instincts are born in us. They are tendencies, that is, a constant leaning or urging in a certain direction; and it is only relatively late in the development of man that he has, with the development of his larger brain, learned by experience to control the urging of these instincts. Their urging is, nevertheless, constantly present, and at times, it becomes insistent.

If in an individual there has been a lack of development of the higher centers producing a condition of mental deficiency or feeble-mindedness, it will readily be seen that there will probably be less control of these instincts and their peculiar emotions; and, in fact, it has been found that it is a bad economic proposition to spend time and money in endeavoring to make soldiers of this class of individual. A certain number of these individuals were enlisted during the voluntary enlistment period owing to the enthusiasms to fill up the ranks of a battalion, and many of them have come back diagnosed as "shell shock." We must also recognize the fact that as the necessary mental control involves effort which might be compared to a physical effort, in that it produces physical fatigue, and as we all have our individual physical limitations, there comes a time when this effort becomes well nigh, if not completely, impossible. For example, if a man has stood the strain for twelve to eighteen months in the line, I personally do not feel like criticizing him for losing his control under exceptional conditions.

INSTINCT OF SELF-PRESERVATION

When a soldier is first introduced to the fighting line, or even under the apprehension of that danger, his instinct of self-preservation will be strongly stimulated, and he will suffer from the emotion peculiar to that instinct, namely, fear. That is natural. Ordinarily the discipline he has learned and his own self-respect are sufficient inducements for him to exert his intellectual power in controlling the impulses set up by his emotions. This intellectual power is, as I have said, a more lately acquired faculty and is more subject to local influences. Lack of sleep or food, or the general malaise associated

with a fever, or anything else that interferes with his feeling of well-being, will lessen his intellectual control. Under such circumstances, the sudden onset of some great danger or horrible experience will stimulate his primitive instinct of self-preservation, whose center is probably in the basal ganglions. The radiations or impulses set up by the stimulation of that center, like the radiations from a powerful wireless station, jam the radiations which are set up in the relatively weakened cerebral centers, so that their message can no longer be read. When one sees a man pulling his rubber sheet over him to hide himself from the shells, one realizes that here is a vivid example of the old instinct of flight and concealment, and that such an individual's higher centers are not acting as they should. Under such circumstances, in the absence of the censor as it were, that individual becomes very suggestible. He is in a mental condition ready to believe anything, especially anything that will relieve him of his fear and relieve the anxiety of his guardian instinct of self-preservation.

MUTISM

In studying cases of mutism, for example, one is led to the following interpretation: one realizes that there is a very close association tract between the emotion fear and the voice centers. If a child is frightened, it cries. The warning cry of animals is the cry of fear. Under intense fear the natural reaction is to cry out. Fear is often so intense that the individual cannot cry, his throat muscles having gone into spasm owing to the strength of the stimulus. When, however, that fear is passed, when the individual attempts to use his voice, owing to the close association tract already mentioned between the voice center and the center of fear, there is immediately called up in his mind the picture of the extreme terror under which he was placed. The mind has a natural protective method of suppressing anything that is unpleasant. If one has a recurring unpleasant thought, he will immediately think of something else. He will shove it down out of consciousness. So in this case the thought of the terror being decidedly unpleasant, the mind suppresses it, and with it the voice—so that it will not be recalled.

FUNCTIONAL DISTURBANCES

In the same way the functional paralysis of the arm may result from an injury received when the individual is suffering from great emotional strain. The natural reaction to fear, the quickening of the heart, the shaking of the knees, the profuse perspiration, the involuntary micturition, strange and unaccustomed symptoms to the ordinary individual, become very potent suggestions of organic disease.

Take, for example, the man who after a week with his battery was returned to the special shell shock hospital suffering from general tremor. When asked what he complained of, he stated that his "nerves were broken," that he was not strong enough to stand the life. When asked if he had been afraid he asserted rather violently he had not—he had never been afraid of any man. When it is explained to him that his nerves could not be broken, that he really meant that he had lost control of himself, he asserted that he was not strong enough to stand the life owing to the fact that he had heart disease and that if he had been examined by the medical officer he would not have been sent to the front on that account. Examination of the heart showed it perfectly normal and on being assured of this, he stated that in any case he had done "his bit" and he should not have to go back to the front. He had done fourteen months' duty on the coast defense in England, and he had taken on this position in the early days when there was little or no protection and he had been exposed to all sorts of weather and hardships. When he received the assurance that we did not criticize anybody for being afraid, that it was a very natural phenomenon, he then admitted that he did have his "wind up" and in fact he had been very much afraid.

COMMENT

If one analyzes this case one sees the natural reaction of the mind in suppressing the unpleasant truth that he is afraid. He violently asserted that he was not afraid of any man. One sees also another natural reaction on the mind in defending the individual to himself. His first defense was that owing to heart disease he was not physically strong enough and when that was put out of court, his second defense was that he had already done "his bit" and that he should not be called on to go the front. When it was pointed out that it was hardly just to compare fourteen months on the coast defense in England with fourteen months in the front line, as many of his fellows in the battery have done, he rationalized his whole condition and was in a position to appreciate the injustice of leaving other men to do his share who, though just as much afraid as he was, were controlling their emotions effectively.

One will appreciate that in order to make an individual thus rationalize his ideas and then appeal to his higher control, one takes for granted that he is a man of average amount of intelligence. In the case of the feeble-minded, such a method is hopeless.

When one realizes the numberless sources of suggestion, one can appreciate how protean may become the character of the symptoms.

TREATMENT

In the treatment of these cases a thorough knowledge and examination of the nervous system is necessary to exclude any organic disease. With the assurance that there is no organic disease present, a broad human charity and a personal interest in the explanation of the individual symptoms are essential. The patient must be made to understand the causative factor played by the primitive emotions and he must be made to rationalize the ideas which have been set up. In this way his discipline, his self-respect, his higher control can be called on to take command again. Involved psycho-analysis according to the freudian idea is, in my opinion, a waste of time and unnecessary.

Certain of these psychogenetic cases I just naturally treated with military sternness, and without much apparent sympathy, simply making them do what they said they could not do, but for which, of course, I knew there was no organic cause to prevent them. Others, I took sympathetically and led them along with reason, persuasion and encouragement. When asked why I made the distinction, I could only answer, at first, that my experience had taught me which was the way to take them. As a rule, whichever method I used, worked well. Realizing there must be some underlying reason for the difference in methods, I was led to the following plan, after reading William McDougall's "Social Psychology."

RATIONALE OF METHODS OF TREATMENT

We have noticed in all these genuine psychogenetic hysteric or pithiatic conditions there is a greatly increased suggestibility which has been produced as a result of the terror under which they have labored. McDougall, in discussing the emotions of admiration and awe, shows that under the influence of either there is an increased suggestibility. In analyzing these emotions he shows that admiration is made up of wonder, plus what he terms a negative self-feeling—a feeling that we are in the presence of a superior power, something greater than ourselves. Certainly we are all in a more suggestible state of mind toward one whom we admire than toward one whom we do not, and we are more likely to be influenced by his words or actions.

In the same way in his analysis of the emotion, "awe," he shows it to be made up of a negative self-feeling, plus wonder, plus a suspicion of fear. Under the influence of "awe" we are more suggestible.

Terror, on analysis, is made up of fear with a much exaggerated negative self-feeling element, and here, too, we have found the increased sensibility.

In all three emotions we have found the resultant increased suggestibility and the only common factor, on the other side of the equations is the negative self-feeling. Therefore, the negative self-feeling must be the cause of the increased suggestibility. When, therefore, I see a man with a psychogenetic disability who is unreasonably antagonistic, self-assertive and inclined to be impudent, I realize that that man has not the negative self-feeling one expects to find in a genuine case and I feel he is more of the malingering type and trying to deceive me, which one naturally does not knowingly permit. Not only that, but to treat these cases efficiently, it is necessary to inspire that necessary negative self-feeling and the consequent increased suggestibility essential in these cases to a rapid recovery. From this one can estimate, also, the harmful effect of unrestrained emotional sympathy toward these patients. Its tendency will be to produce a positive self-feeling which will render attempts at treatment in many cases futile.

TREATMENT BY SUGGESTION

Any methods of suggestion are insufficient, simply diverting as they do the patient's ideas. Hypnotism, which is merely induced hysteria, cannot reasonably be expected to cure; it is granted that by this means the symptoms can often be relieved; it is, however, by superinducing a further condition of hysteria, and the probability is relapse on the first moment of strain and emotion. His condition and disability depending entirely on ideas, cannot be influenced except superficially by drugs or mechanical treatment. Reason is the only thing that will appeal to or change ideas.

If functional paralysis of a limb be present, it is a simple thing to show him by means of a strong electric current suddenly applied, that he has voluntary power in the limb; once having seen this he will call on it. In the same way the voice can be shown to be unaltered. In case of tremor, once the real origin of the trouble is accepted by him, if the patient is persuaded to relax the muscles, the tremor ceases. One always notices that these patients, when endeavoring to control the tremor, put all their muscles tense, which simply serves to increase it.

When a patient is diagnosed as psychogenetic, one should use equally scientific rational methods with him as one would in the case of any bacterial infection. If the patient comes complaining of loss of appetite and, on examination, one finds he has typhoid fever, one does not treat the loss of appetite. One tells him frankly he has

typhoid fever and gives him treatment which has been recognized as reasonable and proper from a knowledge of the pathology of the disease.

If a man complains of a pain in his back and after the most thorough examination we can find no organic disease, we designate it as a neurosis, that is, it is mental in origin. Surely it is not the part of science to give him a plaster jacket. Such action will simply impress on the patient still more deeply the idea that he has an organic lesion and make it more difficult to eradicate.

FINAL DISPOSAL OF THESE CASES

It is evident that the final disposal of the man and his expectation as to pension will have a decided influence on his condition. If by his disability he is going to escape future danger, and is going to receive a more or less satisfying pension, and his future is going to be cared for without any work on his part, he has small inducement offered to him to make the effort to use his higher control. In the French army this has been recognized, and their ruling now is that hysterical disabilities will warrant no pension, no gratuity, and no discharge from the army; that where a definite wound is associated with hysterical disability the latter must not be considered in estimating his pensionable disability and in no case does such functional disability warrant discharge from the army. The result of the putting into practice of this legislation is that it is not worth while to develop shell shock in the French army.

In England, on the other hand, a very different state of affairs existed, and it is only recently that efficient methods have been adopted to treat these cases in special hospitals. Previous to that many were discharged to civil life with a fairly big pension. It was a common experience that even in civil life many of these were inefficient.

Sitting on the special medical board which dealt with these cases, one would see men who had been discharged some months to their own control, who had again become total disabilities. Let me quote two typical cases:

One man had been discharged from the hospital to return to his command depot. On the train while leaning out of the window an engine in the neighborhood whistled. He immediately fell back in the compartment, shaking all over and was returned to the hospital a complete disability.

Another patient who had been discharged to civil life and had been carrying on for some months, while in Paddington station one day there was an air raid warning. Everybody moved toward the underground, this man with the others. An engine in the station whistled; in his own words, he fell down in a severe hysterical convulsion. Somebody threw him into a baggage car and

the train ran out of the station. Its first stop was at Taplow, and he was taken off and sent to the hospital there. When seen, he was walking with crutches, dragging his legs behind him.

In neither of these cases was there any sign of organic disease found. They had been startled by an idea and had lost control of themselves. Being a pensioner, this latter patient would be advised to go to the first home of recovery, a fine old house in beautiful grounds with a fine billiard table and interesting occupation found for the patients. While there he would be receiving 27s. 6d. a week, with 13s. for his wife and so much for each of his children. He would live there for six weeks or two months like a gentleman of means, well cared for and well fed, and with an interesting occupation. At the end of that time, if sufficiently recovered, he would come to the special medical board and might well receive an increase to his pension on account of his nervous instability. Now we saw in the first place that his condition was due to an idea, and we must realize that only reason will appeal to an idea. If all the reasons that are being given a man are such as to encourage him in his condition, it is hopeless to expect that his ideas will be influenced beneficially.

In dealing with this type of case in Canada, we are following the plans which have been adopted in the French army and in the British army in France. We have special hospitals where these patients are segregated immediately on their arrival. These centers are under the supervision of specially trained men who see (1) that no patient showing gross objective functional disturbance shall in the future be discharged from the army; (2) that such psychogenetic condition shall not warrant any pension or gratuity, and (3) in the event of such patients relapsing in their condition after their discharge from the army, they shall be returned to the special neurologic center from which they were discharged.

PSYCHASTHENIA

In psychasthenics, when prewar disability can be demonstrated — and Captain Farrar states it can be in 90 per cent. of the cases — it should, by appropriate treatment, be reduced to as near the prewar disability as possible, and they should be discharged without pension or with pension covering the estimated amount of the aggravation.

With the carrying out of these recommendations, one could justifiably hope for (1) the return of a greater number to military duty; (2) a greater efficiency in civilian occupation in those discharged to their own control, and (3) a very decided diminution in the amount of pension.

FEEBLEMINDEDNESS

With regard to the feeble-minded to whom we have made reference. One recognizes that this condition of mental deficiency was not induced nor aggravated by military service in the great majority of cases. In what way should they be disposed of? When discharged, many of this type drift back to the hospital for a while at least, usually on insufficient medical grounds. While we recognize that this disability does not warrant a pension, it is my opinion that from a national economic point of view, the state should become the guardians of such individuals. They should be collected into colonies where they might be made partially self-supporting at least, under supervision; otherwise they will become the tramps, ne'er-do-wells and criminal class always so greatly augmented in the train of war.

THE HISTOGENESIS OF MULTIPLE SCLEROSIS *

THEOPHIL KLINGMAN, M.D.

ANN ARBOR, MICH.

Multiple sclerosis has steadily held the attention of the investigators for a number of decades, and the careful clinical study of the disease in connection with exhaustive histopathologic research has resulted in a number of theories on the basis of which the more recent histologic studies have given gratifying results.

The newer methods of staining and modifications of the older ones made it possible to differentiate more definitely the tissue elements which enter into the pathologic process and in consequence of this, these have been minutely described. However, it is evident in the conclusions drawn from the results which have been revealed that the interpretation of the tissue changes and their correlation, not only from a histopathologic standpoint, but also in connection with the reaction of certain tissue elements under abnormal conditions and the reaction of a feeble biogenetic balance in the tissue as a whole, is incomplete and the conclusions indefinite. This fact warrants not only a recapitulation, but also establishes a basis for further attempts to correlate the pathologic changes which have caused the structural disorganization in the various parts of the nervous system with the physiologic changes. Further, the careful description of the elements and the changes occurring in them has made it possible to trace the origin of the disease to the embryonic stage.

The basis of this investigation rests on four cases of multiple sclerosis; one of these the writer studied clinically as well; the other three and later the fourth were patients at the state hospitals for the insane where the clinical notes and necropsy protocols were made.

All of the cases were under observation for considerable periods of time and presented sufficient clinical evidence for a positive diagnosis. For lack of space the case histories and clinical notes are omitted from the article, but these will appear in full in the reprints.

CASE 309.—Necropsy—Many of the bronchial glands were enlarged. The glands of the small intestines were found enlarged and, on section, showed cystic change with an abundance of yellow gelatinous substance exuding. The heart weighed 260 gm. The endocardium showed no marked localized change and there was no myocardial change. The kidneys showed only such changes

* Submitted for publication Oct. 30, 1918.

* From the laboratory of the State Psychopathic Hospital.

as those caused by the terminal disease. The liver and spleen showed nothing of interest.

The Brain: The brain weight is 1,270 gm. The pia-arachnoid is cloudy, the subarachnoid space contains considerable fluid, the convolutions are everywhere small and somewhat atrophied, most marked in the frontal and parietal regions. In that position of the supramarginal gyrus, bordering on the Sylvian fissure, there is an area semitranslucent in appearance, of rather firm consistency. A long section passing through the temporal lobe, shows extreme atrophy of the cortex. It is very narrow and the contrast with the underlying white substance is diminished. The convolutions in other parts surrounding this area are widely separated. The gray cortex is unusually dark. The white substance in the center of the hemisphere shows considerable narrowing. A long section passing through the red nuclei shows a surface with extreme congestion of the blood vessels particularly marked in the region of the basal ganglia. There is also the same general atrophy apparent that was observed in the other part of the brain. The basilar vessels are free from sclerosis.

In various parts of the brain there are sharply circumscribed, reddish-gray or grayish-white areas varying greatly in size and shape. In consistency they are more firm than the surrounding tissue and stand out prominently, there being a marked contrast between these areas and the background of apparently normal brain tissue.

CASE 302.—*Necropsy*.—On section of the left lung several small tubercles were found in the upper lobe and there was an area of consolidation in the lower lobe of the left lung. At the apex of the right lung there was a caseated tubercle about the size of a pea. In the lower lobe there was also some consolidation. In the cortex of the right kidney there was a small cavity containing about 2 c.c. of yellow fluid. The spleen showed considerable congestion throughout with atrophy and cloudy swelling.

The Brain: In opening the cranial cavity it was found that the dura mater was adherent to the calvarium. A considerable amount of clear fluid escaped on cutting the dura.

The pia and arachnoid were cloudy. The vessels of the pia were deeply congested. The basilar vessels were atrophied but showed no sclerosis. The brain weighed 1,336 gm., its consistency was slightly diminished, the surface was smooth and the convolutions slightly separated at their tips and a slight degree of atrophy was apparent in the brain tissue about the central longitudinal fissure. The brain was hardened in 10 per cent. formalin. A longitudinal section passing through the middle thalamus shows a narrowing of the white substance of the center of the convolutions, especially in the frontal regions. The central white area of the right occipital-temporal region that borders on the right posterior horn is strikingly different from the left. The central white area on the right side appears to have an uneven cut surface and has dark grayish streaks and blotches leaving very little of the white appearance of the normal tissue. Anteriorly it extends to the posterior border of the insula and posteriorly to the occipital region, leaving only a small tip bordering on the occipital gray free. The lesion extends into the central substance of the second temporal and a little into the third temporal convolution. The consistency of the changed area is firm and cuts with increased resistance. The lateral ventricles appear widened. There are other smaller sharply circumscribed areas in various parts of the brain of the same appearance and consistency.

CASE 412.—Necropsy.—In the apex of the left lung there were old adhesions found. The right lung was not unusual. There was an increased amount of fat about the heart, the heart muscles were flabby, soft and thin. The endocardium was not noticeably changed. The stomach and intestines showed no pathologic change. The liver was large. In the lower border of the left lobe there was a circumscribed nodule about one-half inch in diameter, of a dark blue color. The cut surface of this portion was yellowish-brown and in the center a small cavity containing a small amount of fluid. The spleen was soft but was normal in size. The cut surface was pale red in color and the pulp was soft and easily compressed. The connective tissue was increased. In the kidneys there was nothing unusual.

The Brain: The brain membranes were thickened. The dura mater was slightly adherent. The pia was cloudy especially over the frontal lobes and over the cerebellum. The weight of the brain was $34\frac{1}{2}$ ounces without the meninges. The cranial nerves showed no gross changes. The vessels of the base of the brain were not sclerosed. The convolutions were small and pitted. The sulci were rather wide and flowing. There were several small depressions, as though from atrophy, near the median portion of the frontal lobes. The spinal cord appeared normal, on section the surface was not characteristic. After hardening the brain in 10 per cent. formalin it appeared symmetrical. The pia mater was slightly thickened and opaque over the extreme convexity. The consistency of the brain was firmer than usual. The convolutions in all regions showed great atrophy, most marked over the frontal and central regions.

Longitudinal sections of the brain 1.7 cm. in thickness, show in all regions, in both gray and white substances, spots which are somewhat translucent in appearance of a grayish or reddish-gray color; these vary from 1 to 2.5 cm. and are well circumscribed. The largest are found in the white substance. In the region of the thalamus both optic radiations are involved and small patches are found in the thalamus. The caudate and lenticular nuclei contained numerous small plaques. The right posterior limb of the internal capsule from the knee back to its posterior third is sclerosed. There are sclerotic patches in the corpus callosum and in the external capsule. In the posterior quadrigeminal regions a dense white spot is seen above the median fillet. The pyramidal bundles on the left side look grayish and show involvement. Gray spots are seen in the middle of the pons and in the cresta. The upper surface of the optic chiasm is rather gray and translucent in appearance. The cranial nerves appear normal. The cerebellum shows no involvement. The vessels at the base of the brain are about normal in appearance.

The various spinal cord segments show sclerotic patches in both white and gray substance.

CASE 986.—Postmortem Examination.—The patient died at 8 a. m., March 24, 1915. The postmortem was held at 10 a. m. of the same day.

The body of a greatly emaciated middle-aged white woman. Body heat present. Beginning rigor mortis in limbs. Hypostatic congestion over back and buttocks. Postmortem lividity over the left arm. Third and fourth fingers of the left hand contracted at the second joint on palm. Extreme extension of the big toes, most marked on the left. Hair on scalp and pubic regions brown, abundant.

Panniculus almost nil, deep yellow, dry. Muscular tissue greatly wasted, deep red, dry.

Pleura: On the left side it is free; pleura over the right shows dense adhesions over the entire lung, which separate with difficulty.

Left Lung: Weight, 310 gm. Rather large amount of purulent material poured from the left pulmonary bronchus on the removal of the lung. Upper lobe gray in color, moderate anthracosis, fairly collapsed. Lower lobe enlarged over posterior surface, purplish blue color, tough, airless. Anterior surface of lower lobe comparatively negative. Section over posterior enlarged portion shows lung tissue tough, moist, pits on pressure, frothy bloody fluid oozes forth. Section of the lung in the upper region shows the tissue negative.

Right Lung: Weight, 375 gm. So densely bound by pleural adhesions it is necessary to dissect it out. Upper lobe mottled gray color. Pleura is roughened and shaggy from torn adhesions. Middle lobe pale gray in color, pleura rough and shaggy from torn adhesions. Both lobes are moderately crepitant. Lower lobe is somewhat enlarged, mottled red and purple color, markedly crepitant. On section in the lower lobe the tissues are seen exceedingly moist, pit on pressure, tough, glistening and frothy pale serum streams forth on squeezing. Section of the upper and middle lobes shows them negative.

Heart: Weight, 285 gm. Pericardium thin, rather large amount of clear, straw-colored pericardial fluid. Heart small in size, filled with fluid blood, moderate amount of fat over the right heart. Walls of the left ventricle are moderately thick and fairly negative. Some uneven thickening of one leaflet of the mitral valve, moderate in degree. Valve of the aorta negative. One large patch of sclerosis immediately above one leaflet of the aorta valve, few small patches in other regions. Two of the leaflets of the tricuspid valve show a rather marked thickening. Walls of the right ventricle negative. Pulmonary valve negative.

Liver: Weight, 1,085 gm. Dark red color, surface smooth. Capsule markedly thickened over anterior surface. Walls of the gallbladder considerably thickened, otherwise negative. Liver sections with comparative ease, shows a distinct yellow mottling, is markedly congested, otherwise negative.

Stomach: The stomach is somewhat dilated, unusually elongated, walls are negative. Marked congestion of the mesenteric vessels, moderate enlargement of the mesenteric glands throughout the entire small intestines, most marked in the upper portion. Small intestines negative. Appendix closely bound by its mesentery back of the cecum. Large intestines negative. Abdominal aorta negative.

Uterus: Comparatively negative. Right ovary is greatly enlarged and cystic, tube negative. Left ovary moderately enlarged, beginning cystic degeneration, tube negative. Bladder collapsed, negative.

Spleen: Weight, 80 gm. Spleen capsule negative. Spleen sections with some increase in resistance, shows rather diffuse increase in connective tissue.

Left Kidney: Weight, 90 gm. Very little perirenal fat. Kidney normal in position. Ureter patulous. Capsule thickened, shows a few small cysts beneath it, strips with some difficulty leaving a finely granular surface. Kidney sections with some increase in resistance, shows narrowing of the cortical substance, uneven in character. Pyramids are white and fibrous in appearance. Pelvis is enlarged.

Right Kidney: Weight, 110 gm. Normal in position. Perirenal fat nil. Ureter patulous. Capsule is thickened, strips leaving a very finely granular surface. Kidney sections with increase in resistance, shows some uneven

narrowing of the cortex. Pyramids are fibrous in character. Pelvis is enlarged.

Pancreas: Negative.

The Brain: Weight, 1,060 gm. Calvarium unusually thick in all regions, thickening is greater over the left half, very heavy in weight. Dura is thickened and densely adherent to the calvarium making it necessary to dissect out the brain. Congestion of the superior and lateral longitudinal sinuses. Pia of the convexity is markedly edematous over the extreme convexity especially in the right hemisphere, it is much thickened but to a lesser extent over the base. Convolutions of the convexity show a rather marked flaring of summits and widening of sulci in the frontal, superior central, and parietal regions, most marked on the right. Brain tissue is unusually soft, flattens out of its own weight. Unusually large amount of cerebrospinal fluid. Pia of the base is slightly hazy in cisternal regions and inferior surface of the cerebellum. Convolutions of the base show rather marked widening of sulci with marked flaring of summits in the temporal tips. Basal vessels are thin and negative. Cranial nerves are unusually small. Brain tissues are so soft that blocks of material were taken with difficulty.

Cord was removed; aside from extreme congestion it showed nothing else of note.

As an established routine in the State Hospital for the insane, small blocks of fresh tissue were removed from the various regions of the cerebral cortex and other parts of the brain as well as from the spinal cord and placed in 96 per cent. alcohol, Müller's fluid, Zenker's fluid, and 10 per cent. formalin. The brain as a whole and the spinal cord are placed in 10 per cent. formalin.

When the tissues were received at the laboratory of the State Psychopathic Hospital the brain weight was 1,058 gm. The longitudinal diameters of the left and right hemispheres were 15.5 cm. The transverse diameters were 12.5 cm. The pia matter of the convexity was somewhat thickened, this was more marked in certain areas but this apparently had no definite relationship to any other structure as far as one could observe with the naked eye. The thickened areas were irregularly distributed and of variable size and not well defined. At the base, the changes in the pia were less marked. The arteries at the base showed some atheromatous patches. The sulci over a large portion of the convexity were deepened and widened. The horizontal sections of the cerebral hemispheres at various levels showed no areas of sclerosis or abnormal variations in color. Both the cortex and subcortical white matter and the basal ganglia were free from any pathologic process which could be recognized by the unaided eye. The lateral ventricles were enlarged but their surfaces were smooth. In sections through the pons at different levels the tissue appeared normal. The floor of the fourth showed no lesion. In some of the sections of the spinal cord, especially the cervical region, the contrast between the white and gray matter was lacking and there were more or less distinct variations in the color in both the white and gray substance. The tissue surrounding the larger vessels in the central gray substance of the cord showed a contrast which made these vessels stand out prominently. A similar contrast was noticed in the posterior root zones and on one side in the anterior root zone which extended to the margin of the cord posteriorly and some distance inward on the inner side of the gray horns.

HISTOGENESIS

It will be noticed that the serologic examination of the cases reported is incomplete, but many sections of the tissue were examined by the Levaditi silver method for the *Spirocheta pallida* which failed to show this organism. All of the tissue from the four cases which was examined revealed, in general, a uniform histopathology.

Microscopically, one recognizes in the Weigert preparations numerous demyelinated areas of varying size mostly oval or circular and definitely isolated in the brain; more often were the areas in the spinal cord coalesced. These were all much larger and more irregular than any of the areas observed in the brain except those situated in the central gray matter and in the extramedullary nerve root zones. Here the areas were well isolated and stood out prominently. In both the anterior and posterior extramedullary nerve roots similar well defined areas proved to be of special interest owing to their varied structure and characteristic architecture. The topographic distribution of the areas shows little difference in the cases under consideration, though the extent of the process varied greatly in the different cases. In the brain of one of the patients the optic radiations of the left side showed the largest number of sclerosed areas.

The areas were well isolated and could be traced through its entire length. In the same case the ependymal lining of the posterior horn of the left lateral ventricle showed a marked granular ependymitis. The toluidin blue preparations gave a striking picture which made it possible to quickly recognize and differentiate the areas by the prominent nucleated zones. Of these areas certain of them have two, others three well defined circular nucleated zones, one involving the central blood vessel, another the perivascular area and still another the tissue surrounding the demyelinated area. In the areas where but two nucleated zones are in evidence the adventitial tissue contains numerous nuclei arranged in a circular manner indicating the inner zone while the neuroglia tissue surrounding the area has an increased number of nuclei forming the outer zone.

The nuclei belong to a variety of cells which vary in the different areas. In the area presenting three definite zones they are the constituents of fat granule cells and large and small neuroglia elements. There are also other mononuclear and polynuclear cells of various types.

In the two zone areas they are the nuclear elements of large mononuclear and polynuclear neuroglia cells and smaller neuroglia, and the nuclei of an embryonic cell type. There are other nucleated areas which present a uniform structure throughout in which the elements are of one type in various stages of development. They have no definite arrangement but lie within the vessel wall.

In the van Gieson and Mallory phosphotungstic acid hematoxylin preparation the fiber structure of the areas presents a variable picture. In the areas that have three zones the newly formed fibers have a reticular arrangement, while in the areas that present but two zones, the neuroglia fibers in the inner zone appear as undulating trabeculae concentrically arranged, while those of the outer zone are reticulated with finer fibrils in the meshwork.

In the third type the fiber structure is arranged in circles and whirls, they lie in bundles and stain a deep blue in the van Gieson and Mallory preparations. This type is further differentiated from the other two in that they occur in the spinal cord and in the nerve roots only.

The toluidin blue preparations show the changes in the nerve cells as those of axonal reaction, acute swelling and simple atrophy. These variations are not isolated with the variations of the types of areas although certain changes in the nerve cells predominate in the different areas, so that the areas having three zones show a greater number of cells having an avoid form with a granular cytoplasm and a somewhat eccentric nucleus, while those having but two zones, the nerve cells in the surrounding issue show more frequently a narrowing of the body with an eccentric nucleus and displaced chromatin. Many of the cells in all of the areas are normal in appearance.

It is evident that some of the different areas may be regarded as stages in the evolution of the sclerotic plaques, but it is also equally certain that other areas cannot be transformed into the characteristic lesion of the disease.

This study is largely an attempt to group the different areas on a cytoarchitectonic basis and to correlate the groups into a process as a whole. No effort is made to cover the subject in general which has been so admirably done by others, especially of late by Dawson.¹

Therefore, it will be necessary to describe in detail the different areas in the endeavor to place them properly in the evolutionary stages according to their elementary constituents and then to group them accordingly on an embryogenetic basis.

The shape of the demyelinated areas as brought out by the Weigert myelin sheath stain is usually oval or irregularly round, and is more or less sharply defined from the surrounding tissue. In the majority of the areas the lumen of one or more blood vessels is in evidence. The blood vessel wall appears in various stages of disintegration with a proportionate cell infiltration in the remaining connective tissue meshes and a cell proliferation in the vicinity of the vessel and near the outer border of the demyelinated area. Other vessels show well

1. Dawson, J. W.: *Rev. Neurol. and Psychiat.*, **15**:47 and **16**: No. 12, 1917.

preserved or thickened walls. In the Weigert preparations there are great variations in the color of these areas, some retain no myelin sheath stain, others are faintly but uniformly stained, while others are irregularly stained, which is due to various stages of myelin disintegration. In the van Gieson preparations it is apparent that the cellular elements, their arrangement, and the changes within them vary with the staining qualities shown in the Weigert preparation. The silver impregnation method gives evidence that the axis cylinders have been retained within areas where the myelin sheath is absent, but are not so well defined and there are greater variations in size and shape as well as in position. Some of the areas in the Marchi preparation show no black staining, characteristic of degenerating myelin nor is there evidence of fat granule cells in the Herxheimer preparations, while in other areas there are numerous fat granule cells filled with well stained irregular granules. Bordering the sclerotic area, interposed between it and the normal tissue, are numerous nuclei of small and large glia cells, some of which show pronounced glia trabeculae. The glia tissue has a reticular arrangement in some of the areas, in others the fibrils radiate almost perpendicularly to the vessel wall apparently having their origin from the cells situated in the tissue spaces.

The variations in the cellular elements of the demyelinating areas are best shown in the toluidin blue and original Nissl preparations. The former give excellent pictures of nuclear and cellular structure in the various stages of development.

The most striking features in such areas are the variations in the cells which enter into the process. In some of the areas there are numerous, regularly placed, large, protoplasmic glia cells encircling or nearly so, the apparently normal vessel wall. These cells lie in the perivascular neuroglia tissue and in the adventitial wall. The lumen of the vessel is dilated, and either empty or containing a few red blood cells and an occasional leukocyte. In other areas, here and there are irregularly scattered, in the various layers of the vessel wall, cells of the same type but showing well marked variations in the cytoplasm and in the nuclear structure.

In the adventitia one observes an increase of nucleated elements which are mostly small, round and deeply stained nuclei with a small amount of protoplasm. Occasionally a few round vacuolated cells with a central or peripherally placed nucleus are present; these are absent in many of the areas. In the perivascular tissue, in the adventitia, and in the media of the larger vessels, but especially in the adventitia of the capillaries and precapillary vessels there are, among the other cells, single or in groups, large cells with a homogeneous

cell body, their nucleus is large and vesicular with a definite membrane and one or more deeply stained nucleoli. The position of the nucleus is central though sometimes eccentric, and they may be multinucleated. Some of the cells show bilateral indentations and even lines of division giving the appearance of a just completed cell division (Plate III, Fig. II—18). Among these cells there are still larger ones with large protoplasmic processes which penetrate the adventitia of the vessels. In some areas these cells are absent. Here and there in some of the sections one observes dilated capillaries, precapillary vessels or branches of larger vessels which are surrounded by the large protoplasmic cells showing great variations in structure, form and staining qualities. These are apparently representative of the various stages of the development which result in the formation of glia fibers. In the same section, various areas present different degrees of this form of gliosis.

It is apparent in many areas that there is a gradual disintegration of the blood vessel walls which seems to be in proportion to the gliosis and which extends from the periphery, as in some areas there is but an outline of the intima visible. At the periphery of the more or less demyelinated areas there is a proliferation of nucleated elements which are mostly small, round, deeply stained nuclei with a small amount of protoplasm surrounding them. Among them, here and there, is an occasional fat granule cell. These areas show all stages of myelin degeneration. In some of them the demyelination is well advanced in the immediate vicinity of the small central vessel, while at the outer margin there is an irregular loss of the myelin and the process appears as though it extended from the center, concentrically peripheralward.

The vessel wall in some of the areas shows an increase of nuclei and an increase in its fiber density. The processes of the large protoplasmic glia cells have a tendency to follow the course of the fiber trabeculae of the vessel wall; some of them, however, seem to extend gradually in a perpendicular plane toward the lumen of the vessel which stands out prominently in the Mallory anilin blue acid fuchsin preparations. The color contrast is striking and the picture presents bundles of undulating fibers encircling the lumen of the vessel. Between the blue fiber bundles are wide spaces in which appear numerous pink fibers of varying size, some of which follow closely the circular course of the blue fiber bundles, while others run in all directions, and the finer and coarser fibers are closely intermingled (Plate I, Fig. IV). The variations in this differentiation are marked. In some of the vessels the pink stained fibrils predominate, while in others there is a dense blue circular band with but few, fine, pink fibrils

with a small lumen in the center. In other vessels no trace of blue fibers is in evidence, and but few nucleated elements are apparent. The lumen is nearly obliterated and in some vessels beyond recognition.

It is evident from the final results, as shown by the differential stains, that all of these variations are not the products of the same process. In the one the ectodermal, in the others the mesodermal tissue, alone is represented at the terminal stage.

The microscopic pictures of the cellular elements are most varied. There is the simple lymphocyte-like undifferentiated cell type which occurs in the tissue spaces of the capillary, the precapillary and the larger vessels (Plates III and IV—17). This cell is not found in the nerve tissue outside of the perivascular lymph spaces. It was not found in any pathologic condition of the nervous system after studying a large number of preparations of varied conditions. In the glioma there occurs a similar cell; in fact, almost identical except for size. Not any of these cells were as large and regularly formed as the type which will be described presently.

In the toluidin blue preparations (Plate III, Figs. II, III and IV—17), the cell is large, round, sometimes slightly ovoid or irregularly round with a large, round, central nucleus which is of a light blue color usually uniformly stained with a definite nuclear membrane. The cytoplasm is homogeneous, sharply circumscribed and nearly colorless, there is usually the slightest tint of purplish-gray in the cell body. This type occurs single very rarely, two are seen in close proximity. There are from two to five in one area. In longitudinal section they are placed a considerable distance apart, often they are observed where a branch joins the main trunk of a vessel. They are present in the areas marked by the absence of fat granule cells and rarely were they found in areas with a large number of fat granule cells. The distribution of these cells covers the brain, spinal cord and nerve roots, and always in connection with the sclerotic process.

The cells are easily differentiated from the other cell types, especially the lymphocytes, because of the regular size and form of the cell body and the nucleus, the uniform stain of the nucleus and its light blue color and the pale bluish-gray cytoplasm, though some of the cell bodies remain unstained. This type of cell will hereafter be spoken of as "*the undifferentiated cell.*"

In the same preparations and in the same area there are round and ovoid cells with crenate nuclei which are deeply stained and in which a definite membrane can be distinguished. The cytoplasm takes on a deep purple color. Other cells are rather long, ellipsoid bodies, the nucleus of the same shape which is outlined by a fine granular

border which stains deeply blue and the protoplasm purple, and it occupies a central position. Some cells of this type show bilateral indentations in the nucleus, others show the same process in the cell body, and from this form it is possible to trace them to complete division resulting in two large, round cells with a large nucleus which is marked by a finely granular border and homogeneous protoplasm. The cell body is uniformly stained a pale purple. Similar cells show deeply stained, irregular granules in the peripheral cytoplasm which in some of the cells have very fine striations proceeding from them. In other cells the striations are stained more definitely and can be made out as bundles of fine fibrils, and from this type the successive stages in the formation of the large protoplasmic pathologic spider cells can be traced. In either the van Gieson or toluidin blue preparations large *epithelioid cells* are a prominent feature. At first these cells are few, they lie isolated in the adventitial tissue as small, round or ovoid bodies, the nucleus proportionately large with a small amount of cytoplasm surrounding it, but in other areas they are more variable in size and greater in number. In such areas they appear as large central or eccentric nuclei containing a large amount of chromatin which is deeply stained. The changes in the nucleus and the increase in the protoplasm in these cells can be traced until large round cells are formed. From such cells all the stages of development to the fully formed *fat granule cell* are in evidence in the areas where this process predominates. In such areas the nuclei that undergo these rapid changes lie within the vessel wall while those in the perivascular lymph spaces are well formed fat granule cells; further, many areas show the presence of these cells without any marked change in the nuclei of the neuroglia elements. The fat granule cells are found only within the lymph spaces and the vessel wall.

The increase of the nucleated elements within the vessel wall is of several types: In the adventitia occur large, round nuclei with a clear, chromatic framework, surrounded by a round or irregularly round protoplasm of more or less granular structure. These are endothelial cells from the lymph spaces. Other forms of the adventitial cells have darker eccentric nuclei with ovoid cell bodies which show more or less stained substance which probably arises from the connective tissue elements of the adventitia. Aside from these there are fibroblasts, mast cells and a few plasma cells situated within this layer.

The increase of nucleated elements in the tissue surrounding the areas of demyelination is dependent on a number of cell types; there are large nuclei with a clear and regular chromatin structure with a considerable amount of deeply stained protoplasm around the nucleus; other cells show a branching of the protoplasm, and there are forms of

varying size and shape, many of which are multinucleated. In some of the mononuclear cells there are prominent granules arranged in two half circles which almost meet. The protoplasmic processes show fine striations which in other cells prove to be a fibril formation. Some of the cells seem to undergo regressive changes, they appear narrow, having an irregular border frequently in contact with the nucleus laterally; some of these narrow elongated bodies have no nuclei.

EXTENSIVE ELEMENTARY CHANGES OCCUR

From the foregoing it is evident that widespread elementary changes take place, the character of which indicates in part a disturbance of their interrelationship and in part a primary new formation.

In a closer consideration of the different preparations presenting various color pictures and different planes of demyelinated areas one is constantly reminded of the two principal types.

Some of the areas consist largely of numerous fat granule cells surrounding a central engorged or thrombosed vessel with a marked nuclear infiltration of its wall. The myelinated fibers show all stages of degeneration. The nonmyelinated area has a loose meshwork surrounding it, in the spaces of which are fat granule cells with interposed proliferating glia elements. In some of the areas the zone in the immediate vicinity of the blood vessel shows the spaces of the fenestrated structure clear, while in the peripheral portions the fat granule cells remain. This dissolving out of the degenerated myelin and destruction of the cells may occur during the process of preparation, but it is evident that there is a difference in the appearance of the granules in the different stages of disintegration from the variation in the stain, these areas give the appearance of changes found in acute myelitis and are properly termed areas of "fat granule cell myelitis." The axis cylinders are markedly altered in that they are swollen and show great variation in size and staining qualities. In longitudinal sections they are very irregular, and with elective axis cylinder stains (Cajal's and Bielschowsky's methods), they appear, here and there, as finer and larger vesicular granules, and as rows of segments of irregular contour and clumps amidst long rows of fat granule cells which seem to occupy the spaces left by the disappearance of the myelin. Rows of these cells fill the blood vessel sheaths which in cross-sections and under low magnification appear as concentric rings around the blood vessels. The fat granule cells are best differentiated in the sections stained with Scharlach R and hematoxylin. They vary greatly in number in the different areas. There are but few in some areas where the demyelination is advanced and the normal tissue has been replaced by an overgrowth of neuroglia fibers. Closely

related to the foregoing are the areas in which there is an exudate into the tissues surrounding the vessel and into the vessel wall, consisting largely of mononuclear elements and a few red blood cells. This exudate causes a separation of the tissue fibers in the vessel wall and in the tissue surrounding it forming spaces which are filled with elements of the exudate. In many capillaries and precapillary vessels, the endothelial cells have proliferated causing an irregular projection in the lumen of the vessel, and at some of these points there are collections of polymorphonuclear cells which probably represent the beginning of thrombus formation. In a longitudinal section of one of these vessels it appears that the vessel wall is wavy, apparently from unequal resistance in the vessel wall and the surrounding tissue. Here and there are bilateral indentations of the vessel wall which in some places are connected by thin fiber bands containing both mononuclear and polymorphonuclear elements with an accumulation of red blood cells. A marked reaction in the tissue surrounding the area is evident in the increase of the nucleated elements. Fat granule cells and fiber-forming neuroglia elements are in abundance. The Herxheimer fat stain shows the presence of a large number of fat granule cells filled with red stained clumps and granules.

In sections of the spinal cord a number of areas stood out prominently which appeared at irregular distances from each other, following the course of the posterior root fibers. They not only occur here, but also in the central gray matter. In structure, they differ from any of the areas described in the foregoing, which under higher magnification become at once evident in the staining quality and the architecture in general. A number of these areas were easily differentiated on the posterior and the anterior nerve roots, and in the respective root zones. In the region of these areas the extramedullary posterior root in cross and longitudinal sections show a double structure which divides it into two unequal parts, with an abrupt line of demarkation caused by a difference in the staining of the structures (Plate V, Fig. II—31 and 32). The portion lying nearest to the spinal cord shows a fibrous structure containing large, well stained elongated nuclei with blurred ends and with their long axis parallel to the course of the fibers. The other portion presents the picture of a more or less degenerated nerve.

In the van Gieson preparations in cross-section the former shows numerous small disks with a central point, apparently the axis cylinder. The outer zone is stained a yellowish-green with a pink ring and a few deeply stained nuclei giving the whole a sharp contour, resembling the picture of a peripheral nerve, but differing from this in its finer structure and more numerous neurilemma nuclei. Between these areas

there are irregularly scattered, round or ovoid, deeply stained nuclei around which there is just a trace of an irregular cell wall. The nuclei are identical with those found in the sclerosed areas of the spinal cord. Occasionally one sees a round cell with a deeply stained round nucleus. The cell is perfectly clear, the nucleus at times shows a distinct reticulum or regularly placed granules in its periphery with a few larger ones in the central portion. This cell is identical with the undifferentiated cells described in the foregoing. In the periphery of this area there is a marked proliferation of cells and apparently a proliferation of cells in the sheath of Schwann (Plate V, Fig. III—34). There are oblong and ovoid cells arranged in one or two rows; they vary somewhat in structure which gives them the appearance of the cells in the various stages of development which finally leads to fiber formation in some of the areas of the cord. Here and there these clear cells are situated under this stratum and among the cells forming the outer stratum. They are identical with the undifferentiated cells described in connection with the areas of the brain sections. In longitudinal sections the fibers appear yellowish-green with a central line of pink or a deep blue stained center in which there appears a pink line at frequent intervals and an elongated nucleus with blurred ends fading into the pink line.

The elongated nuclei can be traced with the longitudinal fibers of the root into the cord where other blood vessels are found around which a similar process is developing, while in other regions, but along the same course, nodules of varying size with numerous deeply stained elongated nuclei are seen. Near the central canal, in about the position of the central artery and vein, two large nodules represented in Plate IV, Fig. II—24, and Plate V, Fig. IV, show a whirl arrangement of its fibers. In the outer part of each nodule the lumen of the vessels can still be identified showing an intimate relationship with the vessel wall. Numerous long ovoid nuclei are lying in the course of the fibers, with blurred ends completely fusing with the fibers, some of them assuming a curved shape owing to the course of the fibers. The nuclei stain deeply, revealing a granular structure and a membrane with densely distributed chromatin granules. The characteristic features of the nuclei are, the elongated ovoid or cylindrical shape and their arrangement with reference to the fibers, giving a striking contrast to the oval nuclei of the endoneurium and the endothelial cells.

The nuclei of the connective tissue are not so deeply stained nor those of the endothelium. The nuclei belonging to the connective tissue frequently show a transverse direction with reference to the fibers, and both these and the nuclei belonging to the endothelium usually

contain a nucleolus. The area surrounding the nodules in the spinal cord show a dense neuroglia network giving the whole area concentric color differentiation, and it is evident without applying other differential stains that these nodules are not the usual sclerotic plaques, but despite this convincing picture other staining methods were used with interesting results.

The Weigert myelin sheath stain is almost as deep in the nodules as in the surrounding normal nerve tissue, and with a low power magnification these areas stand out prominently owing to the dense proliferated neuroglia surrounding the nodule. Higher magnification shows that the fibers are not so deeply stained as in the normal tissue, but their apposition is closer. There is a marked difference in the staining quality of the different fibers; the longer fibers seem to have taken on a deeper stain while the shorter ones are but faintly stained; the latter are more prevalent in the central part, the former in the periphery.

In the region of the posterior root this process shows an intimate connection with the pial sheath of the root, the pia of the cord, and the pial trabeculae extending into the cord. Here the area assumes a wedge shape with its apex inward and its base resting on the posterior root (Plate V, Fig. I—28); the whole process is apparently within the pial sheath following the course of the sheath, forming a cylinder directed obliquely toward the central part of the cord (Plate V, Fig. II). The cross-section of this region shows that the process remains within the pial sheath and the blood vessel wall. The fibers form in whirls gradually obliterating the vessel wall and eventually the lumen of the vessels. The neuroglia surrounding these areas is exceedingly dense, but in no way connected with the fibers of the rounding tissue (Plate V, Figs. 1 and II).

It is striking that the fibers of the more peripheral areas are more deeply stained and the staining quality diminishes toward the center. The posterior root-fibers show a marked demyelination which is also evident in the intramedullary root-zone. The neuroglia in this region is increased in cells and fibers which, however, does not extend into the pial sheath. This type of nodule was not demonstrated in the brain tissues.

The same sections of the spinal cord show other well defined areas with a structure well differentiated from that just described. Under low power magnification the nuclear elements are strikingly different in size, form, arrangement and staining.

The toluidin blue preparations show areas containing densely nucleated zones extending about a centrally placed vessel. Some of the areas show two, others three, definite zones. The nuclei of the

inner zone are much larger and more irregular in size, form and structure than those of the outer zones. In some of the areas the outer zone shows a greater number of nuclei many of which are identical with those in the normal neuroglia tissue, while those of the inner zone are nowhere found in the neuroglia tissue. These areas are identical with the areas described in sections of brain tissue, showing a progressive neuroglia new formation. Areas of the same structure are also in evidence in the nerve roots and root zones.

SUGGESTED CLASSIFICATION OF THE PATHOLOGIC PROCESS

In the classification of the demyelinated areas one encounters much convincing evidence that the pathologic process can be divided into two main divisions:

1. A process of evolution, which results in the building up of isolated areas of new tissue and the destruction of the tissue in which it develops.
2. A process of retrogression, which results in the breaking down of isolated areas of normal tissue and a reaction in the surrounding tissue which leads to secondary sclerotic areas.

The histology of the different areas is sufficiently characteristic so that they can be isolated on this basis and placed under the two heads. The pathologic changes frequently described as acute, subacute and chronic forms of the disease can, from an elementary standpoint, be classified as stages of the primary progressive process or steps of retrogression. However, there are groups of histologic elements which have no association with the surrounding tissue and do not enter the process of sclerosis, but form definite isolated areas. Such areas were found in the spinal cord and in the nerve roots in three of the cases which furnished the material for this investigation. (In the fourth case the spinal cord was not at hand.) Thus a third division must be made.

A process of evolution in which primarily only neuronic elements are involved and which forms characteristic nodules in the spinal cord and in the nerve roots.

I. PROCESS OF EVOLUTION

The process of evolution which determines the actual or primary sclerotic plaques, the characteristic lesion of primary disseminated sclerosis as designated by Charcot, can be isolated from all other areas according to this classification on a basis of its cytoarchitecture. The areas classified under the first head have no intermediate stage known as "fat granular cell myelitis," nor are there any definite stages in the evolution so far as the process, as a whole, is concerned and not until

retrogression in the areas begins can such stages be differentiated. The study of cell changes in such areas, from the beginning to their final disposition, consists of cell division, transitions to fiber formation, and retrogression of the cellular elements.

It is convenient to describe the areas of this type, occurring in the intramedullary and extramedullary root zones and in the posterior columns of the cervical cord. In the van Gieson and toluidin blue preparations many such areas present a characteristic microscopic picture under low magnification, in that they show two well defined nucleated zones consisting of two or more layers of somewhat variable nuclei. The one surrounding the lumen of a blood vessel, the other encircling the demyelinated area. The earliest deviations from the normal in the structural elements surrounding a capillary or pre-capillary vessel in the vicinity of the posterolateral septum of the posterior column, are indicated by cellular elements in the adventitial tissue or adventitial lymph spaces which are not found in the normal structure of the nervous system. Such elements consist of large round cells with structureless cytoplasm and a central well stained nucleus in which the chromatin is plainly visible. This type of cell varies little in size, and there are few in number. There are larger cells similar in form with perfectly clear cell bodies, and as they vary in size, there are accordingly variations in the nucleus. These variations are differences in staining, in size and arrangement of the stained bodies in the nucleus and in the size and form of the nucleus. Many of these types show no variation in the cytoplasm which remains clear and colorless. There are other cells still larger and ovoid in form which show indications, in the arrangement of the stained particles in the nucleus, of mitotic figures (Plate III, Fig. IV—18); others of the same type show a bilateral indentation of the cell body, while still others show a line of complete division, each stage presents a corresponding variation of the nucleus indicating a previous mitosis. In some of them fairly definite mitotic figures could be recognized. Some of the cells show various stages of division without any indication of a mitosis and it is possible that direct division also takes place. Under higher magnification the cytoplasm appears granular and is faintly stained. The elements increase in size till large protoplasmic fiber-forming glia cells are formed (Plate X). As these cell types increase in number they migrate into the meshes of the deeper layers of the blood vessel wall where they show some variations.

The transversely cut blood vessels show with van Gieson's a well stained pink wall of varying thickness, presenting a wavy connective tissue structure, the meshes of which show irregular spaces in which are seen cells of the type just described. They are all of the same

type in various stages of development as is indicated by their differential staining qualities. The cytoplasm stains faintly, but becomes more decided and variable with the nuclear change until the fiber formation becomes evident. The longitudinal sections of vessels show a similar structure. At irregular intervals the lumen is narrowed by wave-like constrictions. At some points there are wedge-shaped projections into the lumen of the vessel, some of which meet a similar projection of the opposite wall whereby the lumen of the smaller vessels is often obliterated and that of the larger ones narrowed. Under higher magnification it is shown that the structure of this new formation consists of a proliferation of cells of the same type as those described in the cross-sections of vessels.

In the Mallory anilin blue preparations it is evident that there are newly formed capillaries at the margins of the plaques which extend into the newly formed neuroglia tissue of the areas. In the Mallory phosphotungstic acid hematoxylin preparations the neuroglia fibers around each vessel radiate almost perpendicular to the vessel wall no matter in what plane the vessel is sectioned. The fibers are arranged in bundles parallel to one another with more or less interlacing, and more dense in the central portion, and because of fewer fibers toward the periphery of the plaque, the radiations are more apparent, which would indicate that the process extends from the center peripheralward. This is also evident in the more advanced stages where the central portion of the plaque is a structureless mass while the periphery still shows the rays of the neuroglia fibers (Plate VII, Fig. II). The plaque is sharply circumscribed by an abrupt margin determined by the difference in the arrangement of the neuroglia fibers within the area and those in the surrounding tissue. In the plaque the fibers course in regular undulating lines from a more or less definite central point, while in the surrounding tissue the neuroglia has a reticular arrangement. The neuroglia nuclei lie more often isolated, sometimes in short rows or groups between trabeculae of fibers. They are larger, clearer and more variable in form than in the normal tissue. In some of these areas they are more numerous in the central portion, while in others a greater number is seen in the periphery. Between the glia fibers are persistent axis cylinders of variable size and form; they lie either centrally or more or less peripherally, and sometimes at the margin of a clear space marked by the complete absence of the myelin sheath giving the impression of an empty tube in the center or to one side of which there appears the end of a cut cord. In longitudinal section the axis cylinders appear as irregular lines; some of them are thin and fine, others appear as thick but faintly stained bands situated in a clear space abutted by dense neuroglia tissue. The origi-

nal course of the axis cylinder is apparently not altered, as this corresponds to the location and the plane of the section in which it is observed.

The nerve cells in the regions where primary plaque formation occurs are apparently not displaced from their original location, and in many formed plaques there are nerve cells retaining their outline and structure, but others showing more or less intracellular changes characteristic of axonal reaction. Similar changes are seen in the nerve cells of the transition zone.

The van Gieson, Mallory and Alzheimer preparations show marked variations of size in the neuroglia fibers concerned in the areas of this type. The large fibers form bundles into which the finer fibers penetrate and form bundles of fine fibers lying between the larger fibers.

These trabeculae are arranged in regular undulating lines forming concentric layers closely pressed together about a more or less definite central point in which appears a blood vessel or a remnant thereof. The tissue becomes denser and denser until the fiber structure is completely obliterated.

The neuroglia tissue abutting the primary sclerotic plaque shows a greater density than the normal tissue. The nuclei are more numerous, but all relatively small and deeply stained. The tissue forms a dense network composed of fine and thicker fibers forming a narrow but definite zone between the normal tissue and the margin of the sclerotic plaque. The margin of the demyelination of the primary sclerotic area is abrupt. The Bielschowsky preparations show this clearly. There is no gradual fading out of the color within the area which is the case in the transition zone surrounding it. The only connections between the two are the newly formed capillaries extending from this area into the transition zone or vice versa. Sometimes the capillaries lie at the border of the area and follow this line for some distance.

Earlier in the development the axis cylinders can be traced from one zone to another; these show a difference in color which becomes darker as it passes into the reaction zone and finally into the normal tissue. Later they become invisible in the sclerotic area, but can be traced to its border.

In studying this type of plaque in the various sections of the nervous system the impression is received that the process remains the same except for the changes which necessarily follow variations in the normal architecture. The pathologic cell types in the areas of the posterior tracts of the spinal cord can be demonstrated in the areas occurring in the cortex and in the white matter of the brain as well as in the extra medullary and intramedullary nerve root zones. That this is true of the extramedullary root zone is an important factor

with reference to the origin of this type of sclerotic area which will be considered later. However, at this period the impression remains that the areas described under the head of primary sclerotic plaques are of a definite type in origin and development with a constant final disposition forming the essential lesion of the disease known as multiple sclerosis. To recapitulate: these areas in longitudinal and transverse section show a constant elementary structure which consists of newly formed neuroglia cells of the fiber-forming type which apparently have their origin in an undifferentiated embryonic element lodged in the adventitial tissue of the blood vessels. This undifferentiated element shows developmental changes which, when correlated, are the successive stages in a process leading to fiber-forming neuroglia elements and because of the arrangement of the tissue in which they are lodged they encircle the lumen of a blood vessel which forms the basis for the concentric undulating arrangement of the neuroglia fiber trabeculae and the outline and abrupt limitation of the primary plaque formation and the consequent slow demyelination of the nerve fibers in a certain radius. Very different is the development of the narrow reaction zone situated between the plaque and the normal tissue. Here the normal architecture is retained except that there is an increase in the nuclear elements and a condensation of the original meshwork and an alteration in the myelin sheath which is evident in the paler stain as compared with that of the normal tissue.

SYNOPSIS OF PART I

The primary sclerotic area, the essential lesion of multiple sclerosis, is characterized, as observed in toluidin blue and van Gieson preparations, and also Nissl preparations, by two densely nucleated zones, a perivascular and a marginal reaction zone. The perivascular zone consists of undifferentiated embryonic elements, large round and oval neuroglia cells in various stages of proliferation (multinucleated cells and cell division and various mitotic figures) and large protoplasmic cells with extensive protoplasmic processes which show differentiation into neuroglia fibers. The Alzheimer neuroglia cell stain fails to show ameboid forms in this zone. In the same preparations the marginal reaction zone shows numerous small and large nuclei belonging to variable neuroglia cells lying in the neuroglia fiber reticulum. The smaller cells predominate, they are generally round or slightly elongated and may contain one or more nuclei, but little protoplasm. A number of spider cells are irregularly distributed in this zone.

The Bielschowsky and Weigert preparations present a sharply circumscribed demyelinated area which borders on a more or less irregularly demyelinated marginal transitional reaction zone. In the primary

sclerotic area the axis cylinders are more persistent, while in other zones their disintegration varies directly with that of the myelin sheaths.

In the Mallory phosphotungstic acid hematoxylin preparations and the van Gieson neuroglia stains, the neuroglia fibers appear as concentrically arranged bundles placed perpendicular to the plane of a central blood vessel. Between the trabeculae there are finer fibrils which interlace with those of the larger ones. In the marginal reaction zone the normal architecture is retained and consists of a dense meshed fibrillar neuroglia tissue. The blood vessels appear more numerous and their walls are thickened. This arrangement forms a condensation of the normal glia meshwork with a corresponding loss of myelin sheaths and axis cylinders. The demarkation of the two zones is abrupt owing to the difference in the structure of the neuroglia. The Herxheimer preparations do not show fat granule cells or any products of disintegration in the sclerotic area, and there is no stage of "fat granular cell myelitis." Some of the ganglion cells in these areas are well preserved; many, however, show the change characteristic of axonal reaction.

II. PROCESS OF RETROGRESSION

A process of retrogression forming secondary sclerosed areas the result of a reaction incident to the primary lesion.

Such areas occur in the same sections with the primary sclerotic plaque. In longitudinal section of a vessel both types are present. The secondary sclerotic areas in the same preparations are characterized by the almost complete absence of myelin. In this area there are three definite nucleated zones conforming to the outline of the demyelination. Within the area two cell types are prominent, proliferating glia cells with numerous processes and fat granule cells. The larger blood vessels are dilated and have thickened walls, the lumen of the smaller vessels is frequently obliterated. The axis cylinders are persistent in various forms. Observing the inner zone under higher magnification, it appears that there are a large number of cells in the tissue spaces surrounding a blood vessel and in the tissue of the vessel wall including the media where two kinds of cell elements predominate:

1. The large vacuolated fat granule cells with central or peripheral nucleus. These cells are composed of a very large number of irregularly round granules which stain black with osmic acid and a bright red with Scharlach R. Some of the cells are completely obliterated by these granules and appear as a large mass of black or red granules, or clumps forming concentric rings around the lumen of the vessel wall. In this inner zone no granules are found outside of the cells and the narrow spaces between the cells are clear.

2. The large protoplasmic glia cells with branching processes. In the toluidin blue preparations these cells appear in the various stages of development; this is evident in the variations of the large vesicular nucleus which usually shows one or more deeply stained nucleoli. The nuclear variations consist of changes in position and form of the nucleus and in the arrangement and density of its chromatic substance. Closely associated with these are multinucleated cells in various stages of division of the cell body. In the phosphotungstic acid hematoxylin preparations the protoplasmic processes of the cells show minute fibrils which extend between the surrounding elements some distance following the course of the tissues of the vessel wall. In the toluidin blue preparations other cell elements are observed. In the adventitia there are a variable number of small, round cells, with deeply stained nuclei and a small amount of protoplasm; these are proliferated connective tissue elements of the adventitia. The endothelial cells of the capillaries are increased, some of them detached and apparently have passed into the surrounding tissue. They have increased in size, forming large, round cells with a central nucleus in which a more or less definite structure appears. The chromatin stains well, while the cell protoplasm is but faintly stained with hematoxylin. From such a cell the different stages of development can be traced to their final dispositions, as the fat granule cell. In some of the areas they occur isolated in the tissue, in other areas they are present in large number and bear a direct relation to the disintegration of the myelin sheaths. Together with the fat granule cells there are other nucleated elements in the adventitial tissue, and in the toluidin blue preparations which appear as small cells, whose nuclei are scarcely distinguishable from the former. They have dark purplish-blue nuclei and cytoplasm of a lighter blue color in which a few dark blue or purplish granules are present. There are also large mononuclear cells with deep blue or dark lilac colored nuclei.

The cytoplasm of some of these cells is pale blue, in others it is of a deeper blue; it contains dark lilac or deep purple-colored granules. Two other forms appear less frequently. They are about the size of polynuclear leukocytes with purplish or dark blue, irregular-shaped nuclei, and with cytoplasm of a lighter blue in which are embedded numerous coarse, dark purple granules of variable size. Another type of cell frequently observed in the adventitial tissue is a comparatively large cell, irregularly round or ovoid with a deeply stained round or oval, eccentrically placed nucleus. The cytoplasm is comparatively large in amount and stains a deep blue except a small portion adjoining the nucleus which takes on a deep violet color.

These various forms of cells are apparently leukocytes, mast cells and plasma cells, respectively.

The Kulschitsky-Pal and Weigert preparations show a more or less complete absence of the myelin sheaths in the perivascular zone, but few axis cylinders persist, and those present are markedly altered. The glia trabeculae are thickened and the finer fibrils form a reticulum. Some of the glia meshes are obliterated by a dense fibrillary feltwork. Surrounding this zone is an intense proliferation of darkly stained nuclei which are mostly the nuclei of large protoplasmic glia cells, though many epithelioid cells lie between the latter.

In the periphery of the perivascular nucleated zone, the arrangement of the nuclei is more irregular, the nuclei are smaller, more variable and more numerous than in the normal tissue, and the glia fibers form a reticulum. The myelin sheath stain is apparent and shows a gradual increase in intensity toward the periphery until the transition merges into a deep blue color, and thus there is a definite transition zone without an interruption between the pathologic tissue and the normal. While there are striking contrasts in the different areas belonging to the secondary changes, they all have the characteristic elements of a reaction which separates that from the primary lesion and the variations in them are sufficiently definite so that they can be grouped as successive stages of a secondary sclerosis as follows:

1. What may be considered as the first indication of a change in the tissue, characteristic of a secondary reaction, which is best shown in the toluidin blue and van Gieson preparations, is a slight swelling of the tissue meshes. The small capillaries are dilated and engorged with blood, the adventitial lymph spaces show a slight dilation, and in the van Gieson preparations the myelin sheaths do not stain so well in this area and the axis cylinders are swollen and take on a diffuse pink stain. These changes indicate a stasis such as is found in myelitis. In the toluidin blue preparations of the same area there are various mononuclear cell types in the adventitial spaces. These are mostly leukocytes, but there are plasma cells and mast cells which have already been described. In the perivascular tissue the normal spider cells show a distinct enlargement of both the nuclei and the protoplasmic processes. The smaller glia nuclei do not stain so deeply within the areas as in the tissue outside. These changes, though slight, present under low magnification definitely circumscribed areas because of the increase in the nuclear content of the adventitia and the contrast in the stain between the perivascular area and the surrounding tissue.

2. In another area, the next stage in this process, there are large, isolated, epithelioid cells which vary greatly in size and in the staining of the protoplasm. In the larger cells, the nucleus has a definite chromatin structure and the protoplasm takes on a faint hematoxylin stain. Some of them are vacuolated and the protoplasm stained faintly

purple has a distinct membrane surrounding it. These are apparently fully developed "fat granule cells" and mark the beginning of a "fat granule cell myelitis" of other writers which is characteristic of secondary reaction changes. In this area the swelling of the structural elements is more marked. Large protoplasmic glia cells are present, some of which are multinucleated. The myelin sheath of individual nerve fibers is but faintly stained, some of them are unrecognizable, in others only an outline of the myelin can be seen. The axis cylinders are faintly stained and lie in the center or to one side of a clear space. The vessel wall shows a nuclear increase. The endothelial cells are proliferating, some of which have become detached, lying perpendicular and oblique to the vessel wall. Everywhere in the area the small vessels are prominent and give the impression of an increased number within and in the neighborhood of the area, but this is probably because they are more perceptible, due to engorgement and nuclear proliferation.

3. In this area, the following stage appears as an exaggeration of the former. The fat granule cells are more numerous, the whole tissue in the area is permeated with them, they fill every tissue within the area, so that each vessel in cross-section is surrounded by two uniform cellular rings of one or two layers and sometimes three, of fat granule cells, among which are large protoplasmic multinucleated spider cells. The long ramifying processes of the enlarged glia cells extend over a long distance between the fat granule cells following a more or less circular course. There is an increase in the nuclei of the adventitia showing a definite reaction in both the endothelium of the small vessels and in the adventitial wall of the precapillary vessels which at a later stage becomes evident in a connective tissue proliferation which is well shown in the preparation of Mallory's anilin blue stain. There are fibers which stain a deep blue; these represent the connective tissue of the vessel wall; between these is a reticulum of bright pink fibers in the meshes of which are nuclei of the same color. There are also much finer fibers following the course of the connective tissue trabeculae containing elongated nuclei placed parallel to the fibers which are stained pale pink. The fibrils are of the same color. They are of different size, arrangement and color than the neuroglia fibers and nuclei, and must be regarded as fibroglia fibrils and nuclei.

4. The observations made in the Mallory preparations and those which have just been described represent the main histologic features of this stage. The fibrillation is more dense, the nuclei are diminished in number, differentiation of the fibers is more difficult and finally the neuroglia fibers cannot be demonstrated. In the perivascular zone there is already a dense neuroglia fiber reticulum, the cellular elements

are less in evidence. The myelin sheath stain no longer appears, and there are but few persisting axis cylinders which are faintly stained. In the transition zone there is a gradual increasing density of the neuroglia tissue, though the normal architecture is retained. The myelin sheath stain shows an irregular color which is more intense toward the periphery. The axis cylinders are preserved in varying degrees, which is indicated by the variations in the stain. Here and there are a few fat granule cells and an occasional spider cell.

5. The essential feature of this period is a further development of the fibrillar neuroglia tissue. In the Mallory phosphotungstic acid and van Gieson preparations the protoplasmic processes of the large spider cells show a more marked differentiation into the fiber elements, many of which have become independent of the process, but retain a more or less definite relationship to the nucleus. The fibers appear in the trabeculae which assume a parallel position to the direction of the nerve fibers. Between these there is an interlacing, forming elongated and ovoid spaces which are occupied by fat granule cells. The irregular form of many of the fat granule cells within the tissue spaces makes it apparent that they are compressed by the constantly increasing fiber formation. As the fibers become more and more dense, the fat granule cells occur less frequently in the tissue spaces. Some of the remaining cells appear as a vacuole in the dense neuroglia tissue or as an irregular mass of granular protoplasm in which the nucleus is barely recognizable. In the adventitial spaces within the area and in the transition zone there are numerous cells of this type. The structural changes in the cells, and the differentiation of the cells appear most distinctly in the toluidin blue preparations.

The nuclei of many cells are crenated and without a definite membrane, these belonging to the fat granule cells undergoing degeneration. There are numerous nuclei among which the small, round, deeply stained ones predominate which belong to the small neuroglia cells. The other nuclei are those of the larger glia cells and of the endothelial cells.

Finally no fat granule cells remain either in the perivascular tissue spaces or in those of the vessel wall. The glia nuclei are fewer in number than are normally present in the location in which the process occurs, and they are mostly small but retain to a considerable extent the circular arrangement around the vessel wall and in the perivascular tissue, so that the three original zones are easily recognizable (Plate I, Figs. III and IV). In the vessel wall there appear trabeculae of fine fibrils and among them small elongated nuclei whose long axis is parallel to the fiber trabeculae. In the Mallory anilin blue acid fuchsin preparation these fibrils and the nuclei stain red while the tissue of the

vessel wall stains blue (Plate II, Fig. IV). There is apparently a gradual increase in the density of the former which completely obliterates the spaces in the vessel wall and until all of the fibers fuse into a homogeneous mass, which takes on a pale pink stain. The neuroglia proliferation in the perivascular zone is in proportion to the process in the vessel wall. The tissue in this zone has been altered to a dense feltwork and in great part the nuclei have perished. The transition zone keeps pace with the other zones, the glia reticulum shows a greater density though the normal architecture is preserved, nuclei are more numerous and more regularly placed than in the other zones, the axis cylinders are more persistent. In the final stage of complete sclerosis it is still possible to distinguish the three zones which characterize these areas throughout their development and which is dependent on the density of its elements (Plate I, Fig. VI). There are other areas that properly come under the head of secondary changes. The areas described in the preceding pages all have a place in the successive stages of the development of primary and secondary sclerotic plaques.

(This article will be concluded in the February number)

PLATE I. SECONDARY CHANGES IN THE CORTEX

Fig. I.—Secondary lesion of cortex. Perivascular edematous zone (1). Peripheral zone showing neuroglia cell proliferation and nerve cell changes (2). Toluidin blue.

Fig. II.—Cortex showing axonal reaction in nerve cells and pathologic neuroglia cells in the transition zone of a secondary lesion. Toluidin blue.

Fig. III.—Cross-section of vessel at margin of secondary focus. Lumen (5). Fiber-forming neuroglia cells (8). Fat granule cells (9). Pathologic neuroglia cells (10). Phosphotungstic acid hematoxylin stain.

Fig. IV.—Secondary changes in vessel wall following exudate. Dense glia fiber network (6). Vessel lumen (5). Neuroglia fibers pink, connective tissue fibers blue (7). Mallory connective tissue stain.

Fig. V.—Secondary lesion showing the three characteristic zones. Perivascular space (1). Peripheral nucleated zone (2). Perivascular nucleated zone (3). Transition zone (4). Engorged lumen of vessel (5). Toluidin blue.

Fig. VI.—Cross-section of thrombosed vessel showing three nucleated zones of secondary lesion. Perivascular nucleated zone (3). Peripheral nucleated zone (2). Transition zone (4). Silver impregnation method.

PLATE 1

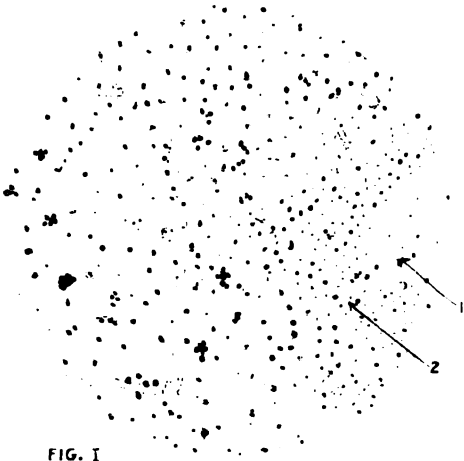


FIG. I



FIG. II

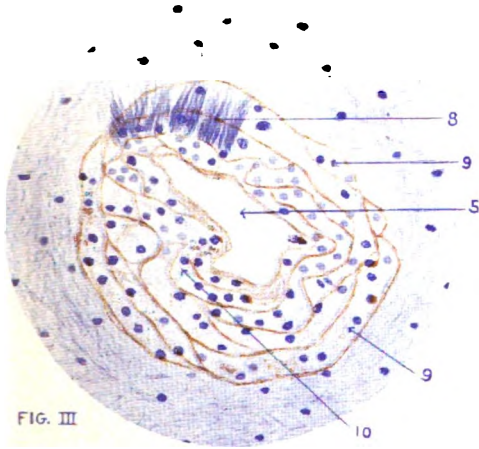


FIG. III

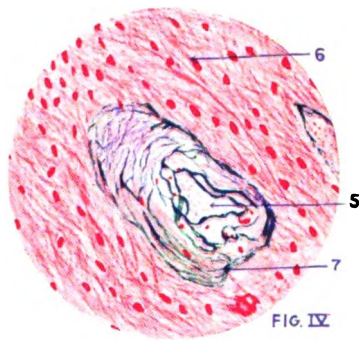


FIG. IV

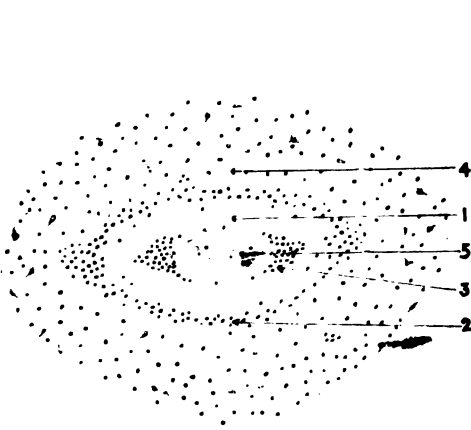


FIG. V

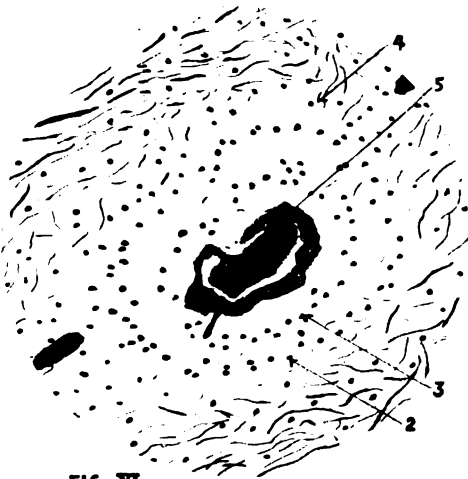


FIG. VI

PLATE 2.—PERIVASCULAR CHANGES IN CORTEX THE RESULT OF A CIRCULATORY
OBSTRUCTION

Fig. I.—An arrested secondary sclerosis showing "areolar area," secondary perivascular changes. Lumen of vessel (5). New formed capillaries (7). Van Gieson stain.

Fig. II.—Secondary perivascular changes the result of edema and softening. Van Gieson stain.

Fig. III.—Longitudinal section of obstructed vessel with exudate showing thrombus formation. Lumen of vessel (5). White thrombus (11). Primary lesion (12). Wedge-shaped projections of the vessel wall, focus of primary lesion (13). Van Gieson stain.

Fig. IV.—Secondary neuroglia proliferation in the perivascular neuroglia zone. Outer perivascular neuroglia zone (3). Pathologic neuroglia cell (10). Multinucleated cell—giant cell—(14). Mitotic neuroglia cell (18). Toluidin blue stain.

PLATE 2

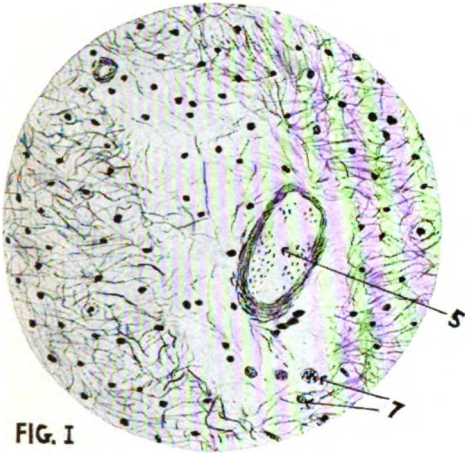


FIG. I

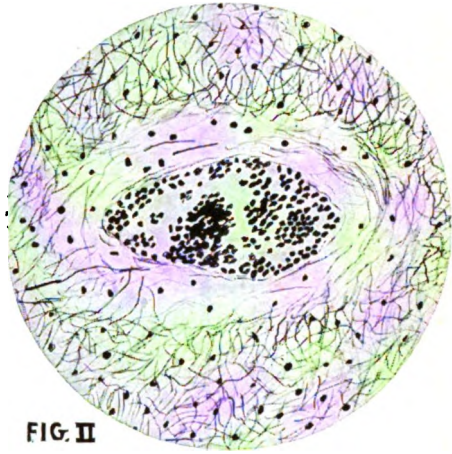


FIG. II

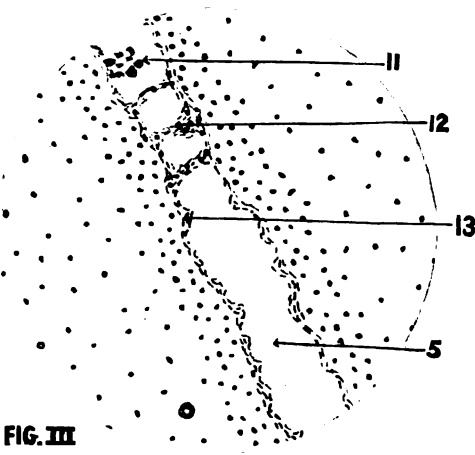


FIG. III

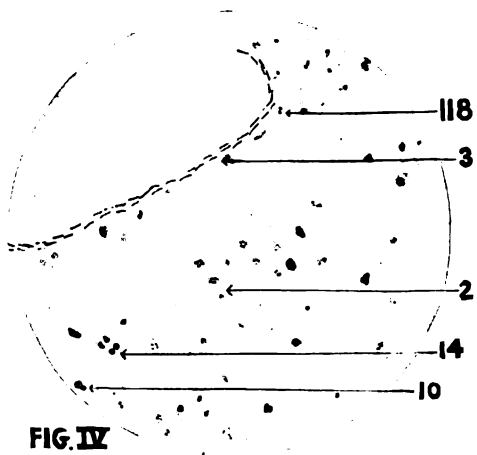


FIG. IV

PLATE 3.—CHANGES IN CORTEX SHOWING CELL TYPES

Fig. I.—Embryonic type of nerve cell showing bilateral indentations and double nucleus. Toluidin blue stain.

Fig. II.—Cross section of a vessel including branch showing cell types in various stages of development. Normal neuroglia (15). Nerve cell (16). Undifferentiated cell (17). Intravascular and extravascular (17); Binucleated epithelioid cells (18). Fibroblast (19). Toluidin blue stain.

Fig. III.—Longitudinal section of an unobstructed capillary showing various cell types. Note beginning changes in nucleus of undifferentiated cell. Undifferentiated cells intravascular and extravascular (17). Mitotic cell (18). Nerve cell (16). Ameboid neuroglia cell (20). Toluidin blue stain.

Fig. IV.—Longitudinal section of engorged vessel showing wavy outline of vessel wall and various cell types both within and without the vessel. Pathologic neuroglia (10). Undifferentiated cells—intravascular and extravascular (17). Mitotic neuroglia cell (18). Fibroblast (19). Toluidin blue stain.

PLATE 3

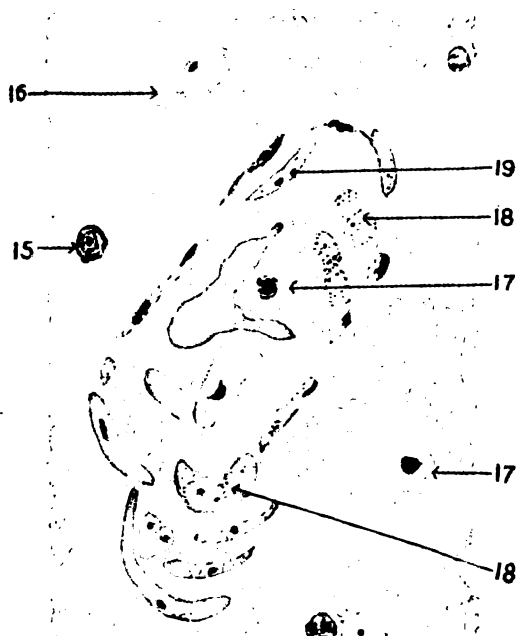


FIG. I

FIG. II

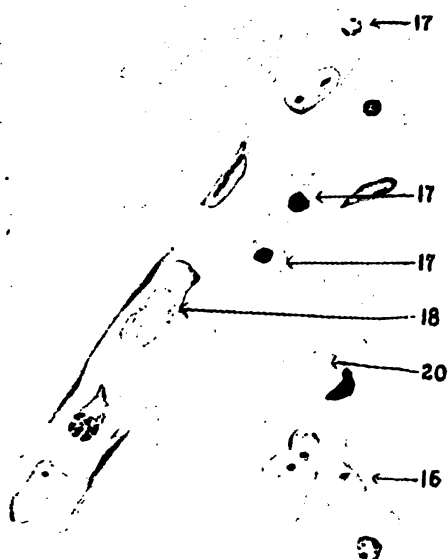


FIG. III

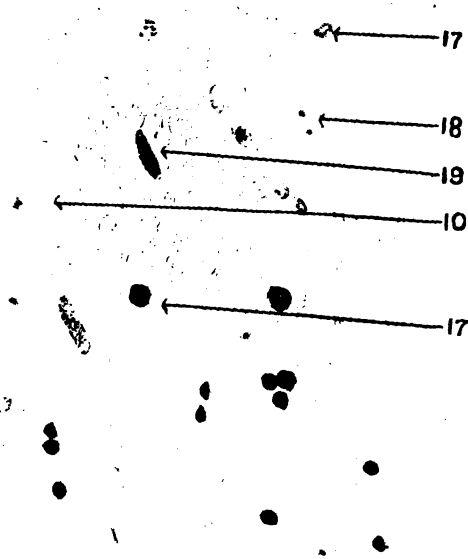


FIG. IV

PLATE 4.—LOCALIZATION OF PRIMARY LESIONS IN SPINAL CORD AND NERVE ROOTS

Fig. I.—Cross-section of thoracic cord showing large demyelinated areas and intramedullary and extramedullary root changes. Primary lesion in anterior root (20). Primary lesion in posterior root (22). Demyelinated areas the result of primary lesion (23). Pal-Weigert stain.

Fig. II.—Cross-section showing neuroma in gray commissure of the cord. Note the chain-like arrangement of embryonic types of cells in the periphery. Neuroma (24). Obstructed blood vessel showing neuroglia reaction zone (25). Central canal of the cord (26). Van Gieson stain.

PLATE 4

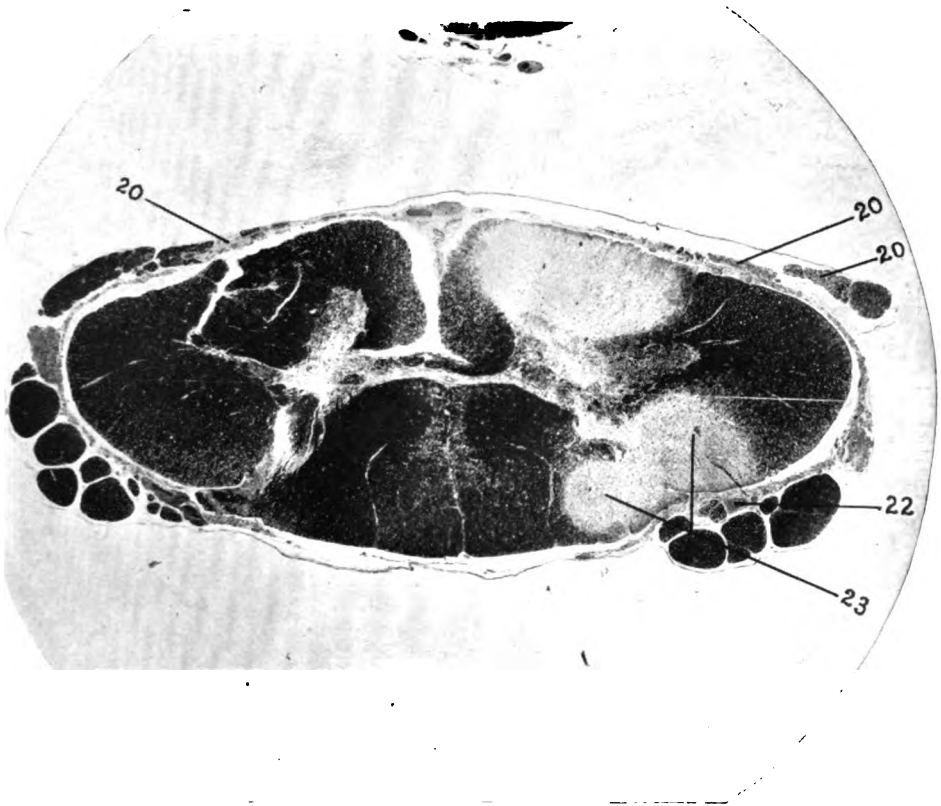


FIG. I

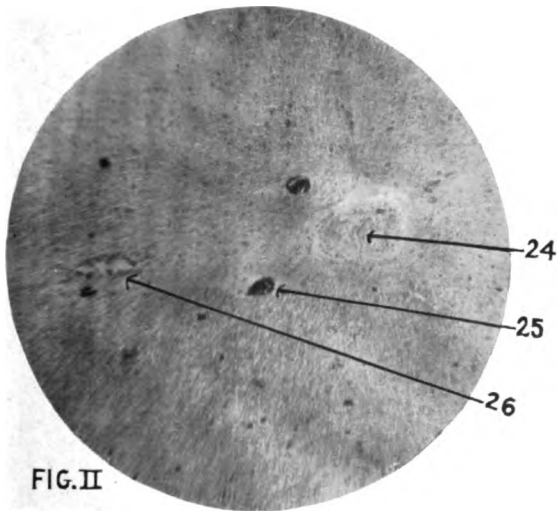


FIG. II

PLATE 5.—CIRCUMSCRIBED LESIONS OF AN EMBRYONIC STRUCTURE IN THE SPINAL CORD, NERVE ROOTS AND ROOT ZONES

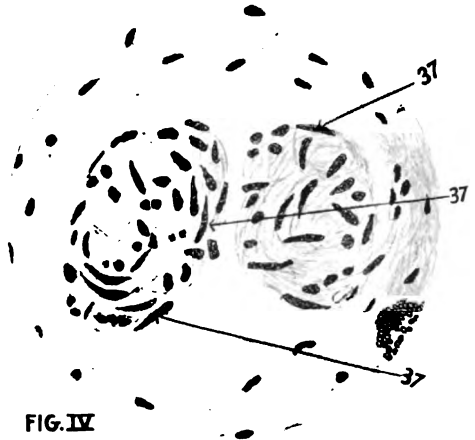
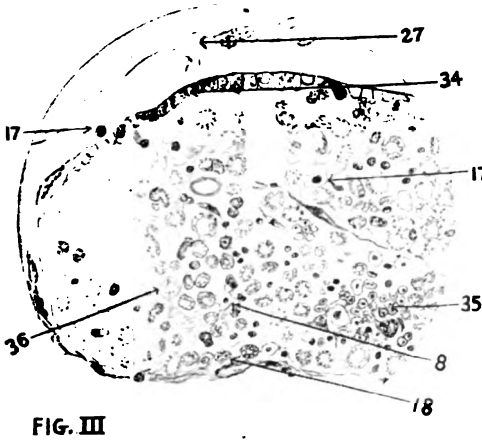
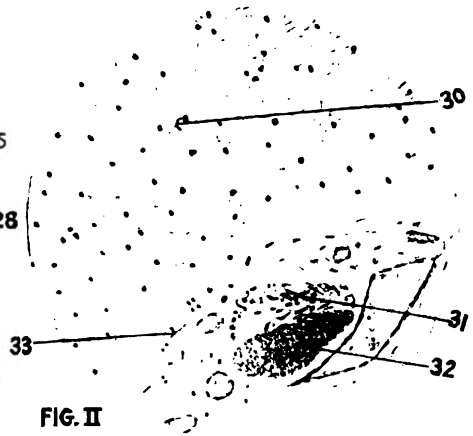
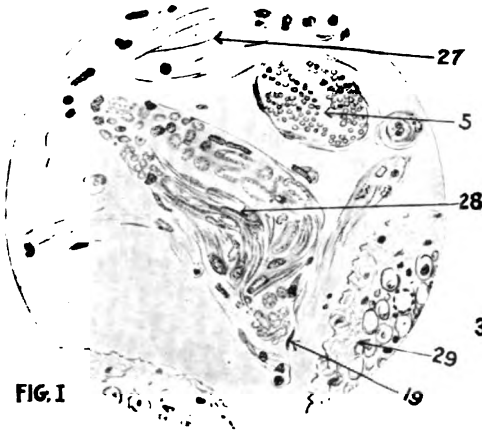
Fig. I.—Embryonic neurofiber formation in extramedullary anterior root. Note elongated cells in the path of the fibers. Lumen of vessel (5). Fibroblast (19). Pia mater (27). Degenerated nerve fibers (28). Cross-section of intramedullary zone showing demyelination and swollen axis cylinders (29). Van Gieson stain.

Fig. II.—Extramedullary posterior root showing plaque formation. Intramedullary posterior root (30). Primary plaque formation (31). Normal nerve root (32). Neuroglia proliferation (33). Van Gieson stain.

Fig. III.—Extramedullary posterior root showing proliferation of cells in sheath of Schwann. Fiber forming neuroglia (8). Undifferentiated cells (17). Mitotic neuroglia cells (18). Pia mater (27). Embryonic cells in Schwann's sheath (34). Normal axis cylinders (35). Swollen and degenerate axis cylinders (36). Van Gieson stain.

Fig. IV.—Neuroma from gray commissure of cord (Photo. Plate II, Fig. II). Neuroblasts showing fiber formation (37). Van Gieson stain.

PLATE 5



SO-CALLED "SHELL SHOCK": THE REMEDY *

FRANCIS X. DERCUM, M.D.

PHILADELPHIA

The problem of the functional nervous disturbances met with in soldiers, is one which, on account of its magnitude and importance, demands serious and frank consideration. Because of the unfortunate use of such terms as "shell shock" and "war shock," erroneous conceptions have become prevalent both among lay persons and among physicians. Shock, we should remember, is a surgical condition associated with or the outcome of physical trauma, gross and organic, such as serious injuries of the head, trunk or limbs. It is an acute condition from which the patient reacts, if he is to recover at all, within a few hours, almost always within 24. It is this condition to which the term "shock" was first applied by English surgeons and to which the term should be limited. The application of the term to the functional nervous disorders observed in soldiers is greatly to be deprecated.

SYMPTOM GROUPS

An examination of the reported cases of so-called shell shock or war shock reveals familiar symptom-groups. The cases can be readily classified under conditions already well known to neurologists. They do not differ in any essential particular from those met with after railroad or other accidents. One need hardly recall the palsies, contractures, mutism, deafness, blindness and other well known functional disturbances met with alike after railroad accidents and after war experiences, to realize their common character; and in reflecting on their nature, we are at once carried back to the history of railroad accident cases and their interpretation. We all recall the change that took place in medical conceptions when the theory of spinal concussion of Erichsen gave way with increasing experience to the recognition of the fact that the symptoms were purely functional in character. Moeli pointed out the mental origin of the symptoms and the rôle played by fear, fright and excitement. Wilkes, Walton and Putnam showed that the symptoms were hysterical in nature. Thomsen and Oppenheim came to similar conclusions though both made reservations as to the partial existence of organic lesions. Charcot maintained that the symptoms are exactly the same as can be produced by hypnotic suggestion; that they are due to hysteria and nothing but hysteria,

* Submitted for publication Oct. 30, 1918.

* Read at the Annual Meeting of the American Neurological Association, Atlantic City, N. J., May, 1918.

and that they have no anatomic basis whatever. In two patients dying of intercurrent affections, one of aneurysm and the other of alcoholism, and which cases came to necropsy, a careful microscopic study of the brains and cords (the results of which were reported by me in a paper read before this society in 1895¹) failed to reveal any lesions whatever. We all recall, further, how the terms spinal concussion and railway spine, once so widely used, were replaced by Oppenheim's term—the traumatic neurosis. Unfortunately the word neurosis because of its vague and indefinite meaning failed to convey an adequate conception of the conditions present. Notwithstanding, the expression traumatic neurosis soon became the vogue and was universally used. Later, however, the hysterical nature of the symptoms becoming more and more evident, it gave way to the expression traumatic hysteria. For a time, also, such terms as traumatic neurasthenia, and hybrid expressions such as traumatic hysteroneurasthenia were employed, but they finally and definitely gave way with an increasing experience to the term traumatic hysteria.

WHAT IS HYSTERIA?

Time unfortunately will not permit of an exhaustive discussion of the nature of hysteria. Let us, however, recall to our minds some elementary though oft forgotten facts; for example, the origin of the name from the Greek word for uterus, *hystera* (*ὑστέρα*), and the theory of the wandering uterus of the ancient Greeks; a theory which persisted in some form or other down to the days of Lepois, Sydenham and Willis, when hysteria was finally recognized as a nervous disease. Subsequently, it was variously regarded as a disease of the spinal cord or of the brain by Ollivier, Todd, Porter and Georget. Later, Briquet denied that it had anything to do with the spinal cord or any of the viscera, but that it had its origin in a dynamic disturbance of those portions of the brain that have to do with the affects and perceptions. We all recall the historic clinical studies of Charcot and of his pupils Paul Richer and Gilles de la Tourette, which in due course followed, and the elaborate chartings of the symptoms to which these studies gave rise. Moebius later emphasized the fact that all of the symptoms of hysteria are psychic in origin, but the next really great advance was made by Babinski. We all recall Babinski's experience with his 100 consecutive cases of hysteria not previously examined by physicians, which he tested for hemianesthesia and in which suggestion being carefully avoided, he failed to elicit the symptom in a single case. What was true of anesthesia proved to be true of the other symptoms as well. All are the result of suggestion.

1. Dercum: J. Nerv. & Ment. Dis., August, 1895.

The next fact of importance to be realized is the following: If we test a healthy or normal individual for anesthesia, making at the same time free use of suggestion both direct and indirect, we invariably fail to develop the symptom. In other words, the normal individual repels, the hysteric individual accepts the suggestion. It is this vulnerability to suggestion, this feebleness of resistance, which forms one of the fundamental features of the neuropathy of hysteria. Further, just as the reaction of the hysteric subject to suggestion is excessive and pathologic, so is his reaction to emotional stimuli. That the hysteric patient laughs and cries more readily than does the normal person is a fact of common experience. Emotional instability and exaggerated emotional expression are symptoms of every-day observation. The hysteric person is more readily frightened than is the normal person, and both the fright and its manifestations are commonly out of all proportion to its cause. Very frequently the latter is trivial; so much so, at times, as to be practically nonexistent. Among the many causes other than fright which may induce excessive emotional reaction in hysterical persons, are, as we all know, annoyance, disappointment, mortification, fancied slights, wrongs or insults, grief, shame, the shock of sexual experiences, the worry over sexual peccadilloes and kindred matters.

Given a reaction to suggestion and to emotional stimuli that is excessive, it follows as a physiologic corollary, that the mental state should express itself outwardly in an excessive physical reaction. Thus, the outward manifestations of fright are commonly very great; sometimes so much so as to appear to be in excess of any possible emotion. What is true of fright is, of course, true of all the other mental states. It is for this reason that an idea communicated by suggestion expresses itself in hysteric persons with such extraordinary ease and rapidity in some corresponding outward reaction.

The facts justify no other conclusion than that hysteria is an affection which is innate in the individual; the hysterical woman or hysterical man is born, not made. Hysteria, further, is a neuropathy of degeneracy. Hysterical persons with few exceptions occupy the ranks of the incapables. They lack endurance, lack persistence, lack fixity of purpose, lack those staying qualities which are necessary to bear the strain of life, to meet the exigencies of existence. In keeping with this fact, heredity naturally plays a large rôle. The hysterical strain can very commonly be traced from a hysterical mother through her various children. Again, the family histories may reveal other neuropathic disorders, mental disease and alcoholism. Charcot and his pupils regarded hysteria as an affection always inherited; all other factors have merely the value of "agents provocateurs"; the latter are merely incidental and at most lead to the development of surface and

outward manifestations; they do not produce the underlying neuropathy. That already exists.

It is further significant that cases presenting crass hemiplegia, hemianesthesia, contractures, blindness, deafness and like symptoms are found almost exclusively in the outpatient departments of hospitals and in hospital wards. The private rooms rarely contain them. They are rarely found among the better middle or higher classes. The hysterical claimants in the courts, too, are usually at the level of the outpatient class. There is here a fact of profound biologic significance. Hysteria when met with in the upper classes usually expresses itself by a more recondite and more purely psychic group of symptoms; but no matter how presented, the facts lead inevitably to the scientific inference that the neuropathy which we term hysteria is expressive of a biologic inferiority.

INFLUENCE OF ACCIDENTS IN DEVELOPING SYMPTOMS

Let us now turn our attention to the rôle of accidents in the development of symptoms and to the influences which determine the persistence of the latter. Of necessity our consideration must again be brief. However, we are at once impressed at the outset by the fact that, in the development of symptoms, trauma unconnected with fright plays no rôle. It is a noteworthy fact that trauma occurring during sleep or during surgical anesthesia is never followed by hysteria. Again, it is a matter of common experience, that persons injured during sports, in gymnastic exercises, in foot-ball, never develop hysteria. To these facts it need hardly be added that, in the absence of the preexisting neuropathy and in spite of the undoubted presence of fright, trauma likewise fails to develop hysteria; as witness the rarity of the affection in locomotive engineers, firemen, brakemen, conductors, motor men, iron workers, and the like.

The next truth for us to recognize is that the phenomena of hysteria persist so long as the suggestion which called them forth persists. A hysterical woman may have a fall and subsequently because of the associated fright and the suggestion of injury into which the occurrence resolves itself, may present a hysterical paroxysm. Most frequently persistent hysterical phenomena, such as palsies and anesthesias, do not ensue immediately; indeed, not until some time has elapsed; time is necessary for the suggestion of injury to become fully operative. It is here that the lessons taught by hysteria following accidents which lead to claims for compensation, are especially instructive. In hysteria evoked by accidents uncomplicated by claims for compensation, the interval of time is usually short and the later-developing symptoms, if any, rarely pronounced. The latter, as a rule,

fade and disappear spontaneously, or readily under the suggestion of treatment. However, if the attitude of those about the patient, or the character of the treatment instituted, or ill-advised remarks by the physician confirm the belief in injury, the symptoms may persist for a very long time. Especially is this the case if the patient be made an object of interest, of sympathy, or of coddling care. This is a point of very great importance, for under such circumstances the symptoms may persist almost indefinitely. However, in the vast majority of cases uncomplicated by such factors, the symptoms never become pronounced; they rapidly subside, and the individual soon resumes his usual condition.

When we turn to the lessons furnished by hysteria involving claims for damages, the picture, as we know, is a very different one. The presence of the element of compensation introduces a factor which influences alike the development, the intensity and the duration of the symptoms. Four years ago, in a paper read at the Albany meeting of this Association, I fully considered this subject, basing my statements on 447 personally studied cases which presented the characteristic picture of accident hysteria. (This paper was subsequently expanded and has since appeared in book form.²)

The facts influencing the development and the persistence of symptoms may be illustrated as follows: An individual has been frightened by an accident; perhaps he has received a few inconsequential bruises or other injuries in themselves insignificant or perhaps absolutely no physical injuries whatever; he becomes immediately the object of care on the part of by-standers and others; and sooner or later as a result of the suggestion of injury presented by the accident, reenforced by incautious questionings and repeated medical examinations, he develops frank hysterical phenomena—weaknesses, palsies, anesthetics or what not. The pernicious influence of repeated and needless medical examinations, fraught as they are with suggestion, cannot be too strongly emphasized. Sometimes even the initial fright of an occurrence has been slight, has not been evident to bystanders, or has itself never taken place; but the patient, as a result of witnessing the effect of the accident on others, himself develops hysterical symptoms—usually somewhat later, sometimes after several days or even a week or two. Perhaps he stood around at the time of the accident, assisted others, walked about unattended, and yet subsequently, after suggestion has had time to become operative, he develops hemiplegia, blindness, deafness, convulsions, or perhaps some other hysterical manifestation.

2. Dercum: *Hysteria and Accident Compensation*, Philadelphia, The George T. Bissel Co., 1916.

In hysteria ordinarily, the symptoms are often fugitive and shifting, and often rapidly subside either spontaneously or under suggestion and persuasion. It is unnecessary to point out again that, on the other hand, they may be confirmed and prolonged by the injudicious conduct of friends and relatives and especially by an unwise and unnecessary course of treatment. Further, a lesson also applicable to the hysteria of war, may be gathered from the influence of litigation. The influence of litigation or rather of the expectation of compensation, constitutes a remarkable proof of the fact that the symptoms persist so long as the suggestions which called them forth persist. Under these circumstances the most radical and persistent efforts at cure fail unless the suggestions have been eliminated. In the paper read at Albany just referred to, I placed on record from the large amount of material at my disposal twenty cases in which the symptoms had been so pronounced that in each instance the plaintiff had been carried into court on a stretcher or was—so it was alleged—too seriously injured to be brought into court at all, and in each of which a speedy disappearance of symptoms ensued after the claim for damages had been disposed of; and this too when the symptoms had persisted for many months and in a number of instances for several years.

The foregoing facts in regard to accident hysteria are in general accord with those presented by other writers. Among the latter may be mentioned Schultze, H. Sachs, Erben, Ziehen, Huebner, Morselli, Heynold, Bondurant, Winderscheid, Bailey, Murri, Wallace, Crook, Malone, K. Mendel, Schaller, Milton, Byron Bramwell, Boone, Dye, Morselli, Dillon and Sir John Collie.³

HYSTERIA FOLLOWING SHELL SHOCK

When we turn our attention to the hysteria of so-called shell shock, a parallel series of facts present themselves: (1) as to the preexisting neuropathy; (2) as to the occurrences which evoke the symptoms, and (3) as to the causes which lead to the persistence of the symptoms. The preexisting neuropathy has been emphasized by Osler,⁴ Forsyth,⁵ Mott,⁵ Adrian and Yealland,⁵ Wolfsohn⁶ and by others. In Viets'⁷ excellent digest of the English literature of shell shock, the facts are summarized by the statement that "it has been found in a large majority of cases of shell shock that the patients have a neuropathic

3. Refer to bibliography, Dercum: Hysteria and Accident Compensation, footnote 2.

4. Osler: J. A. M. A., **69**:290, 1917.

5. Quoted by Viets (Note 9).

6. Wolfsohn: J. A. M. A., **70**:303, 1918.

7. Viets: J. A. M. A., **69**:1779, 1917.

tendency or inheritance." Viets quotes Forsyth as saying: "In all cases coming under the writer's notice with symptoms which were more than mild or transitory, a history of some earlier nervous troubles, slight or severe, was forthcoming," and further that "the occurrence of a definite neurosis is to be looked for only in psychopathic individuals, the onset representing the collapse of what is already unsound." Again, Adrian and Yealland in a report on 250 cases say: "There are certain mental abnormalities which are present to some extent in nearly every patient. The majority of patients are below the average normal intelligence as judged by the Binet-Simon scale, and others who are more highly equipped prove to have an unstable history either personally or in the family." Finally, Viets quotes Mott as saying: "Of even greater importance than the extrinsic conditions in the causation of military unfitness from exposure to shell fire are the intrinsic conditions, for if there is an inborn timorous or neurotic disposition, or an inborn or acquired neuropathic or psychopathic taint, causing a *locus minoris resistentiae* in the central nervous system, it necessarily follows that such a one will be unable to stand the terrifying effects of shell fire and the stress of trench warfare."

The same general truth is also recognized by G. Elliot Smith and Pear,⁸ who express themselves as follows: "It is thus obvious to anyone who gives the matter any serious consideration, that the manifestation of a severe psychical shock must necessarily be determined in a large measure by the nature of the mind on which the injury falls. It would be idle to pretend therefore that, in diagnosis, the story of the patient's past experience can be left out of account, for the manifestation of the injury will obviously depend largely upon the individual patient's 'mental makeup.'"

In his introductory note to Wolfsohn's⁶ important paper on the predisposing factors of war psychoneuroses, Col. Pearce Bailey, gives a brief summary of the reports of eight medical officers, detailed for study in shell shock hospitals in England during the summer and fall of 1917 and, among other things, states that in respect to etiology these officers all lay much stress on constitutional predisposition. Wolfsohn's conclusions as to this point are extremely interesting. He studied 100 cases of war psychoneuroses and found that the vast majority were among soldiers who had a neuropathic or psychopathic soil. In 74 per cent. of these cases a family history of neurotic or psychotic stigmata, including insanity, epilepsy, alcoholism and nervousness, was obtained, while a previous neuropathic constitution in the patient himself was present in 72 per cent.

8. Smith and Pear: Shell Shock and Its Lesions, 1917, p. 16.

CAUSATION OF THE SYMPTOMS

When we turn our attention to the occurrences which evoke the symptoms, we again find that they do not differ in kind from those met with in railroad accidents. The intense emotional strain, severe fright, as well as the vivid suggestion of injury are equally present in both instances. These are facts so evident that it seems hardly necessary to emphasize them. Further, the parallelism between shell shock and railroad accident cases becomes more and more apparent the more we study the subject. Ames,⁹ for instance, states that "war shock never develops in a sleeping man when a shell bursts near him," a fact which is equally true of persons asleep at the time of railroad accidents. He tells us further that "crack regiments have fewer men coming down with war shock as do old regiments with long traditions of pride." No doubt the reason is that in such regiments neuropathic individuals have been largely eliminated.

Other facts in close accord with our knowledge of the hysteria of civil life are also presented by shell shock. Thus Ames states that throughout the war it has been a matter of continuous comment that *wounded men* did not have war shock, a fact in keeping with the absence of hysterical symptoms in the physical injuries of railroad accidents. Again, Ames states that the large percentage of war shock cases have their onset some time after the shock, some of the men being for several days without any symptoms at all. Here we have again an exact parallel of the fact observed in railroad cases, namely, that time is necessary for the suggestion of injury to become operative. Other facts are equally significant; for example, Ames tells us that among officers there is a relatively smaller percentage than among privates. MacCurdy¹⁰ in his discussion of Ames' paper stated among other things that the paraplegias, the blindness, the mutism, tics, etc., occur preponderately among the private soldiers and further said that this corresponds to the experience in civil life, where functional palsies are rarely met with outside of dispensary practice. When officers do suffer, it would appear that they present symptoms largely psychic in nature, just as do the hysterics met with in the upper classes and upper middle classes in civil life.

FURTHER OBSERVATIONS

Many other facts suggestive of the psychology of shell shock might be added. For instance, *prisoners of war* do not have shell shock; no doubt partly because to a hysterical subject to be a prisoner of war implies safety to life and limb, immunity from the dangers of

9. Ames: J. A. M. A., 69:2145, 1917.

10. MacCurdy: J. A. M. A., 69:2146, 1917.

battle; at least for the time being. Again, *wounded men*, as already stated, do not have shell shock; a wound in a hysterical subject implies removal from the front; dismissal, temporary or permanent. Gaupp, quoted by Elliot Smith and Pear,⁸ states, in discussing cases in which nervous trouble, uncontrollable in nature and intensity, had led to the patients being kept in German hospitals for months, that it was sometimes found that the mental foundation which was a causal factor of these troubles was a more or less conscious anxiety concerning the possibility of a return to the front. In short, we have here a series of facts more or less parallel to those noted in the accident cases of civil life in which both the evoking of the symptoms and their persistence are dependent on suggestions. These suggestions are often doubtless subconscious in their operation, at least they are not frankly admitted by the individual. Finally, the causes cease to be operative the moment that the suggestion disappears, as witness the practically immediate recovery of the hysterical claimants for damages when litigation ceases and the claims have been disposed of.

PREVENTION OF WAR SHOCK

Without further consideration, let us turn our attention next to the important question of prevention. Can war shock be prevented, or, if it cannot be prevented, can it be minimized? Obviously, there is only one remedy, and that is as rigid an exclusion as possible of neurotic and neuropathic individuals from the ranks. Others, for example, Osler and Salmon, have expressed themselves emphatically on this point. It is the duty of the medical examining boards and especially of the medical advisory boards to eliminate such persons with the utmost care. Surely we should profit by the experience of the countries that have preceded us in the war, notably England, and as far as possible prevent the accession to the ranks of material not only worthless for actual fighting, but which greatly reduces the efficiency of the Army and clogs and clutters its hospitals.

SUGGESTIONS AS TO TREATMENT

Next, what shall we say as to the treatment of cases after they have occurred? In considering this question, it is most interesting to note the change which took place in Paris previous to the war, both in the management of hysteria and in the results achieved. This change followed Babinski's remarkable and convincing interpretation of the symptoms. The patients now ceased to be made the objects of suggestive medical studies, of interest and of special care; they no longer occupied the center of the stage; convulsions, gross palsies or

other manifestations were alike ignored as though they had no existence, and the inevitable result followed. In the summer of 1913, Babinski stated to me that major hysteria had disappeared from the hospitals of Paris. This is a remarkable fact and one which must influence our attitude toward and our treatment of the hysterics of war.

The attitude adopted in France is most interesting and significant, and may be properly regarded as just and final.

At a joint meeting of the Neurological Society of Paris and the chiefs of the military neurological and psychiatric centers, on Dec. 15, 1916,¹¹ a discussion was held on the relation of the neuroses and psychoses of war to dismissal from the service, to unfitness for service and to gratuities. The discussion was most elaborate and detailed. Those participating in the part on the neuroses were Grasset, Babinski, Léri, Souques, Henry Meige, Laignel-Lavastine, Dide, Chiray and others. After its completion, the following conclusions were adopted:

1. For symptoms purely hysteric (pithiatic) neither dismissal from the service nor gratuities.

2. For cases in which hysteric (pithiatic) symptoms are associated with organic affections, either physiopathic or mental, no account is to be taken of the hysteric manifestations in the evaluation of the degree of the incapacity.

3. For physiopathic disturbances (nervous disturbances termed reflex) consecutive to traumatism of war and refractory to a prolonged treatment: auxiliary service or temporary dismissal with gratuity in amount proportioned to the functional interference.

4. For neurasthenic states, well marked, even without objective or mental disturbance; most often auxiliary service, exceptionally temporary dismissal with or without gratuities.

These conclusions need no comment and no explanation; least of all do they need a defense.

The most potent remedy for shell shock is, as has already been emphasized, its prevention by the exclusion of individuals unfit for service. The most satisfactory plan of dealing with it after it has occurred, would seem to be that instituted by the English. At first the cases were sent from the evacuation hospitals in France to special hospitals in England. Here general physiological measures, virtually a rest treatment, with psychotherapy, occupation and what not were instituted, but with results that were only partially successful, and even when patients were supposed to have been restored, they not infrequently relapsed on the way back to the front.

11. *Revue Neurologique*, November-December, 1916, p. 750.

As mentioned by Bailey:⁶

Quite recently the attitude in respect to the management of this condition has undergone a marked change. Eighty-five per cent. of all shell shock patients are not now returned to England at all. It has been found much better to treat them nearer the front, and any release from military discipline is regarded as unfavorable for recovery. Moreover, the general methods of treatment, such as diversional occupation, extra diet and entertainments, have been replaced by more rapid and much more satisfactory procedures. Electricity given for psychic effect, which at first was disapproved, has been found to be a valuable agent. This is accompanied by strong persuasion. Cases are reported cured in this way in a few hours which had formerly endured for months, and had resisted all other methods. The personality of the medical officer is a most important factor.

It is important to note that as regards dismissal from the service, the position of the English is identical with that of the French. At times a rational explanation of the symptoms to the patient has been efficacious in bringing about their disappearance. Elliot Smith and Pear⁸ state:

It has repeatedly happened that as soon as the patient was asked about his troubles, he made a full statement of all that was troubling him and was obviously relieved to confess his worries to some one who took an intelligent interest in his welfare.

An intelligent man of strong will, whose social relations have hitherto been normal and happy, might be temporarily "bowled over" by the emotional stress of the campaign, but after a few explanations he is often set on his feet again.⁹

Psychoanalysis has been advocated by Adrian and Yealland, and to a less degree by Eder and by Elliot Smith and Pear. Hypnotism has been used by Eder and others. In the Paris discussion, Lortat-Jacob stated, that he obtained good results by appealing to the individual's sense of honor and by publicly administering an oath. However, after all is said and done, in a given number of cases, the symptoms persist.

Salmon¹² says:

It is evident that the outcome of the war neuroses is good from a medical point of view and poor from a military point of view. It is the opinion of all those consulted that with the end of the war most cases, even the most severe, will speedily recover, those who fail to being the constitutionally neurotic and patients who have been so badly managed that very unfavorable habit-reactions have developed. This cheering fact brings little consolation, however, to those who are chiefly concerned with the wastage of fighting men. The lesson to be learned from the British results seems clear—that treatment by medical officers with special training in psychiatry should be made available just as near the front as military exigency will permit and that patients who cannot

12. Salmon, T. W.: *The Care and Treatment of Mental Diseases and War Neuroses (Shell Shock) in the British Army*, *Ment. Hyg.*, 1:509, 1917.

be reached at this point should be treated in special hospitals in France until it is apparent that they cannot be returned to the firing lines. *As soon as this fact is established military needs and humanitarian ends coincide.* Patients should then be sent home as soon as possible.

Should we in this group of cases, institute an elaborate physiologic, a Weir Mitchell plan of treatment? I should answer no; at least, not for an extended period of time. Further, under no circumstances should the patients be released from military discipline, although for obvious reasons it may prove best not to attempt to utilize them again at the front. It would also to me seem wisest after an interval to inform them of this decision. Forsyth tells us that "if the patient knows he will not return to trench warfare, he will make a more rapid recovery." Such cases may later prove useful in auxiliary service.

After all, however, the proper remedy for shell shock is the strict exclusion from the draft of material alike unserviceable, contaminating and demoralizing and most expensive from the point of view of military economics. Of course, the line should be drawn as sharply as possible between out and out malingering and hysteria. In this connection the willingness to deceive and exaggerate, not infrequently seen in hysterical subjects should also be borne in mind. However, with Gaupp, I am not inclined to look on the pure hysteric as necessarily a malingerer. The hysterical person is one burdened with a defective organization, which is, as I have already phrased it, expressive of a biologic inferiority.

Finally, it should be remembered that the conclusions of the Neurological Society of Paris and of the chiefs of the Neurological and Psychiatric Centers do no injustice to the sufferers from pure nervous exhaustion. That under the severe nervous overstrain of war, fatigue symptoms should present themselves and often in a pronounced degree, is no more than could have been expected; but this is a very different matter from shell shock.

COMPLETE DIVISION OF THE SPINAL CORD IN LOWER DORSAL REGION

A CASE WITH CONSERVATION OF SPINAL REFLEXES BELOW
LEVEL OF LESION *

W. F. SCHALLER, M.D.

Associate Professor of Medicine (Neurology), Leland Stanford, Jr., University
SAN FRANCISCO

SUMMARY OF CASE HISTORY

An adult man rendered totally paraplegic following fracture of the tenth dorsal spine and consequent direct injury to the cord. First observation one year and three months after injury. Examination disclosed exaggerated inferior tendon reflexes, accompanied by pathologic pyramidal tract signs, marked defense reactions, preserved muscle tonus and patellar clonus. Total absence of voluntary motion in lower extremities. Involuntary action of sphincters, decubitus ulcers over both hips. Absolute anesthesia below the ninth and tenth dorsal radicular skin distribution. Because of the abnormal motor phenomena a compression of the cord was suspected, and a laminectomy performed by Dr. Emmet Rixford, Feb. 3, 1917. A complete division of the cord tissue proper was found. The ends of both cord fragments were trimmed off and preserved for future examination. An effort to suture the two ends of the spinal cord was made and found impossible. Reexamination Feb. 22, 1917, nineteen days after operation, showed the same clinical signs as before operation.

History.—B. F. H., aged 46, on Oct. 12, 1915, fell a distance of 8 feet from a walk plank placed over two ladders; he landed on a carpeted floor; had no recollection of the manner of his fall, his last remembrance of the occasion being the swaying of the ladders toward the wall which he was painting. No one saw him fall, but he was found unconscious immediately afterward; he remained so for about 20 minutes; on awakening he complained of severe pain in the pit of his stomach, felt "dead" below the waist, and was unable to move any of his muscles below the waist; sensation was abolished below the same line. After the injury there was retention of urine, necessitating catheterization for about ten days; a mild cystitis was set up which subsided in a few weeks; this retention was succeeded by loss of voluntary control which has persisted to date. The urine dribbles away but also comes at times in quantities; there is a sensation of pain in the region of the bladder, which precedes urina-

* Submitted for publication Dec. 4, 1918.

* Read at the Annual Meeting of the American Neurological Association, Atlantic City, N. J., May, 1918.

tion. Defecation has been involuntary since the accident, although bowel movements have not been continuous. It is necessary to take large quantities of physics to produce a motion. Often the simple insertion of an enema tube will be followed by a bowel movement. Enemas are not found to be as efficacious as the foregoing. Burning pain in the epigastrium and along the costal margin continued to be very severe after the injury requiring morphin.

Three days after the fall the patient was operated on by Dr. George White of Sacramento. The exact nature of the operation is unknown to patient, but he was told that the operation was one of decompression. An excellent operative recovery was made, but no improvement in motor or sensory function resulted. Following an attack of malaria six weeks after leaving hospital, decubitus ulcers developed over both trochanters and in the gluteal fold of the left side, and these ulcers have persisted to the present time. In the past year the condition has been practically unchanged. Subjective sensation of burning and tingling are said to be present in the soles of the feet, in the epigastrium and along the costal margins. The general physical condition has remained good, weight has been constant or slightly increased, appetite is good, and sleep excellent. The patient states that within a month after injury "life" came back into lower extremities—there were twitchings observed in both legs; and definite movements were said to have taken place about two months later. These movements were a drawing up of the lower extremities; they increased in force and extent up to within six or eight months from the present date—January, 1917.

Neurologic Examination.—This was made, Jan. 29, 1917. It revealed a total paraplegia of the spastic type, no voluntary movements at the ankle, knee or hip joints, some contraction of the abdominal muscles most marked in the upper part of the abdomen. Inspection of the dorsal spine presents a gibbus at the ninth to tenth dorsal spines. No muscular atrophy in the lower extremities is noted that cannot be accounted for by disuse, with the possible exception in the right thigh muscles where there may be some true atrophy; this is more marked posteriorly. Decubitus ulcers present over both hips.

Reflexes: Patellar and Achilles' tendon reflexes both present and very active. Babinski, Oppenheim and Gordon reflexes positive. Ankle and patellar clonus is active but inhibited almost immediately by spasm of the quadriceps group.

Sensibility: Superficial and deep sensibility totally lost below the level of the ninth to tenth dorsal segments; the sensibility for pain and temperature is lost about from 4 to 5 cm. above the loss for light touch, and the levels vary on the two sides of the body as shown on the accompanying chart. After the examination has been continued for a certain time the levels of anesthesia are found lower at the end of the examination as compared with the beginning of the examination. The levels are constantly higher on the left side of the body than on the right—this is particularly well marked posteriorly. It is noteworthy that no areas of distinct hyposensibility or hypersensibility exist at the level of anesthesia, which appears sharp and well defined. Position of great toe not recognized. Pressure sense appears to be perceived at first, but it is a question whether patient does not sense certain reflex movements. These reflex movements of the nature of defense reactions are constantly present by stimulation of both the plantar and dorsal surface of both feet, most readily by pinching the skin and by pin prick, but also, though to a lesser extent, by heat and cold. They consist of an exaggeration of the tendency of the great toes to extension and flexion at the ankle, knee and hip. Excitation of the skin of the leg and thigh cause less marked reactions excepting in the right quadriceps region.

Roentgen-Ray Examination.—Made by Dr. Walter Boardman, Jan. 25, 1917. "Examination shows narrowing of the body of the tenth dorsal with obliteration of the tenth intervertebral space and angulation of the spine at this spot."

Impression: Traumatic injury of spinal cord above the lumbar enlargement and opposite the level of the tenth dorsal vertebra. The possibility of a compression must be considered because of the paraplegia of the spastic type and the prominence of the defense reactions. Exploratory laminectomy was advised.

Operation.—The operation was performed by Dr. Emmet Rixford, Feb. 3, 1917. Dr. Rixford's notes on the operation follow:

Assistant, Dr. Melville E. Rumwell. One lamina removed below the gibbus. Evidence of considerable new growth of bone at the site of Dr. White's laminectomy, so that the cord was very well protected. The cord being exposed above and below it was found to be completely cut off at the



Fig. 1.—Constant tendency to extension of the great toes in the resting stage.

level of the gibbus. It was noted that there was cerebrospinal fluid within the dura below the point of injury. It, therefore, seemed probable that there was connection across, but this could not be found by means of a probe passed from either above or below. The scar which united the dura was then split longitudinally and an effort made to trace connection between the upper and lower dural sacs, but this was not successful. The dura was then lifted off the bone and the upper part turned upward and the lower downward. With a chisel, a considerable amount of the bone of the anterior wall of the canal was cut away, especially the upper edge of the eleventh dorsal vertebra. It would appear that the injury consisted of a driving forward of the tenth on the eleventh dorsal vertebra. The cord was absolutely cut across with no detectable fibers of communication. When at the lower border of the wound the cord was touched, the legs contracted. Evidently the injury was chiefly above the lumbar enlargement. There was no pulsation of the dura, but it expanded and contracted with respiration. This was detected also after the dura had been lifted off the bone and the parts

definitely separated. It was therefore quite evident that the pulsation and variation in pressure due to respiration was a local matter in the cord rather than the result of transmission from the brain. The dura was drawn together with catgut and an attempt made to suture the cord. The ends of both fragments were trimmed off and preserved for examination. Two catgut sutures were then passed through the spinal cord in an effort to draw the ends together, but it was not possible to approximate them within less than one-half inch.

Condition After Operation.—The patient made a good operative recovery. Re-examination neurologically, Feb. 22, 1917, nineteen days after operation, showed practically the same clinical findings as before the operation. The following details were noted: When questioned as to sensation in the lower extremities, the patient states that he feels tingling, numbness, sensations of heat and cold and also pain at times in the feet, legs and thighs of both

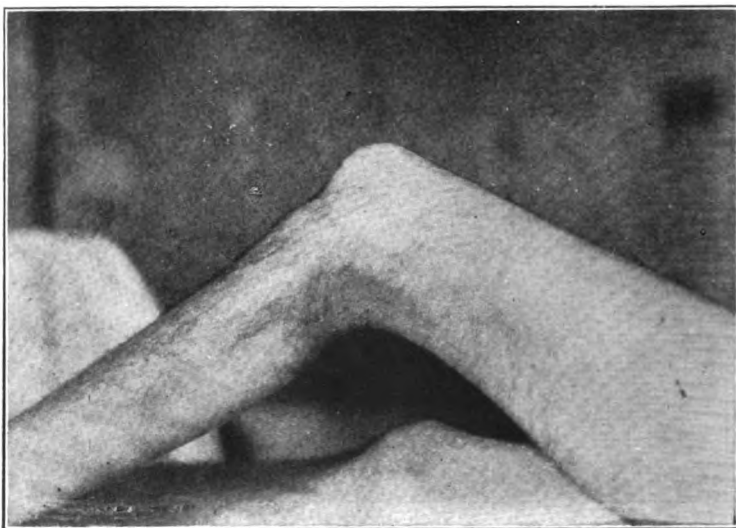


Fig. 2.—Flexor response by defense movements.

extremities. He states that he can feel the breeze from an electric fan in the room. Re-examination of the sensibility revealed the same levels of anesthesia for cutaneous sensation. Deep sensibility lost, tested by the Luer fork for osseous sensibility, by pressure and by notion of position. The subjective sensory impressions were judged to be the hallucinations of sensation and also due to transmitted impulses from reflex defense movements.

Reflexes: Babinski and Schaeffer reflexes are present bilaterally and constantly; Oppenheim present, questionably, however, on the left side. Gordon and Mendel-Bechterew reflexes are variable, at times absent. Patellar and ankle jerks very lively.

Muscular System: A comparative atrophy existed in the paralyzed limbs and rump, but was of the degree which is found in emaciation or disuse. Electric examination by both faradic and galvanic currents showed response of the muscles without qualitative change. There was, however, a relative hyperexcitability to both forms of current, amounts of galvanic current as high as 10, 15 or 25 ma. being necessary to produce muscular contraction. The

external popliteal nerve was excitable to the electric current. Tonus: The muscle tone was found either normal or increased.

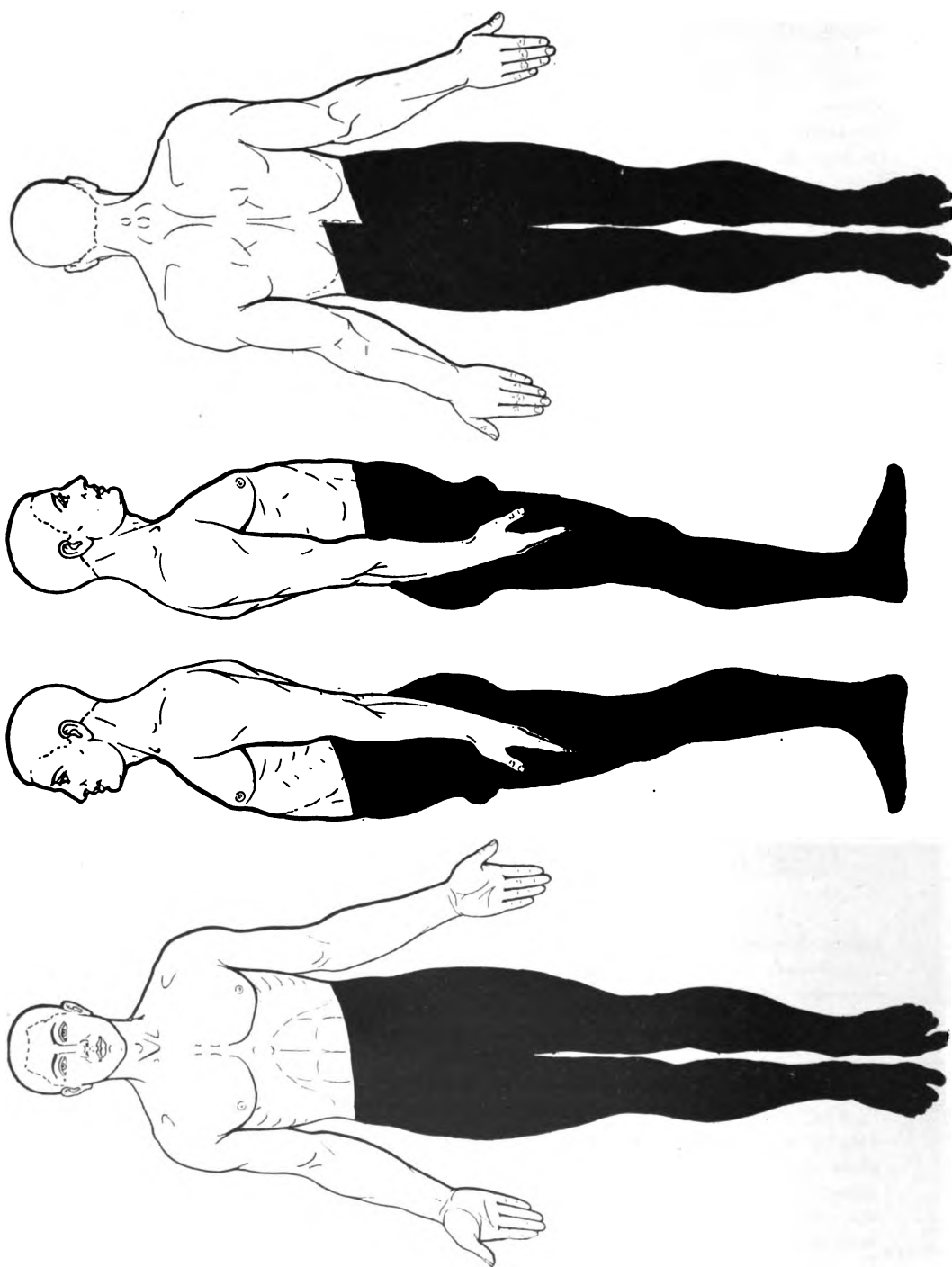
Reflex Defense Movements: As the patient lay in the supine position the lower extremities were in extension, but it was noteworthy that the great toes were slightly extended rather than partially flexed as seen in flaccid paralysis. On irritation of the plantar surface of the feet this extension was so markedly increased that the great toes were at an approximate right angle to the plane of the foot. Repeated examinations of the plantar, tibial and calf reflexes gave the impression that the Babinski sign was the most frequently positive, the Oppenheim less often so and the Gordon reflex was at times evidenced by flexion rather than extension of the great toes. As to the reflex defense movements proper, they were elicited most conveniently by pin prick. It was not established that touch produced these reflexes except pinching the integument or rather pressure. As was the case in previous examinations, temperature also



Fig. 3.—Extensor reflex in the Babinski sign.

produced the defense movements. The flexor sign of Marie, *signe des raccourcisseurs*, was present. By pin prick different surfaces of the lower extremities, anteriorly, posteriorly and laterally, were stimulated, with the result that the movements were generally of the same kind, irrespective of the site of stimulation, namely, in flexion. The thigh was flexed on the pelvis, the leg on the thigh, and the foot dorsally flexed on the leg. The tendons of the sartorius, the adductors, the hamstrings, were seen to contract.

The patient was questioned as to whether the lower extremities were ever forcibly involuntarily extended from the flexed position. This was stated to be sometimes the case. By passive motion of the lower extremities at the different joints there occurred at times a certain rigidity of the member in extension, the knee not being readily bent and the foot plantar flexed. These movements were not as vigorous as the movements of flexion just described. In observing the muscular contractions in the flexor movements, there was observed a concomitant and independent movement and increased tonus in the anterior thigh and calf muscles as if the muscles of the entire lower extremity were brought



Black areas indicate complete sensory loss (superficial and deep sensibility). There is complete absence of sensibility below the level

into play, but the flexor movements predominating. The flexor and adductor movements of the thigh were vigorous enough to retain the thigh flexed on the pelvis for quite an appreciable length of time after the stimulus has been withdrawn, and held adducted so as not to fall outward by its own weight, but remaining a considerable distance above the level of the bed. The tendons of the adductors and sartorius were seen to stand out boldly leaving between them a considerable fossa. During the examination there was observed a partial erection of the penis. Patient stated that on occasions there was a complete erection, but without any sensation of sexual desire. The state of the anal and vesical sphincters have been previously mentioned and remained the same.

Subsequent Examinations.—The patient was next examined, March 3, 1917, and two days previously also, for the height and localization of areas which, when stimulated, produced defense reactions. It was found that on the anterior aspect of the thigh, these reflexes did not take place when stimulation was applied above the lower third of the thigh or at most above the upper half of the thigh. On the posterior aspect of the extremity and buttocks, however, reflexes took place when points as high as the ischii were stimulated; and in the thigh and leg it can be said to be true that stimulation on the posterior aspect of these portions or the lower extremities, produced more active and strong contractions than stimuli applied to the anterior aspects of the extremities. In the foot, there appeared to be no difference in intensity of reaction on plantar or dorsal stimulation. The patient, after the foregoing examination, returned to his home in the Sacramento valley and was not re-examined until Nov. 17, 1917, and on this date the following note was made: Patient examined in Live Oak, Calif.; with the exception of a complication bladder infection, the condition remains about the same. In particular, contra-lateral reflexes were tested for, but neither defense movements, the Babinski toe reflex nor contralateral adductor reflexes, were noted in the contralateral limb, following any kind of stimuli to the one lower extremity.

The patient was next examined, Jan. 1, 1918. The neurologic status was practically unchanged at this time. The general condition of the patient, however, was not so satisfactory, as the bladder infection, in spite of extreme care, appeared to be progressive and was suspected of ascending to the kidneys. Particular attention was directed on this examination to the state of the skin reflexes and the existence or nonexistence of contralateral reflexes. No contra-lateral responses were observed. The plantar reflexes were only present on the side stimulated; also the defense reactions were present only on the side stimulated, and in eliciting the patellar reflex and percussing the different bony prominences in the lower extremities there were no contralateral adductor responses. The left cremasteric reflex was definitely present; on the right side a slow vermicular contraction of the scrotal musculature was observed differing from the quick cremaster reflex as seen on the opposite side (Dartos reflex). The abdominal reflexes were not found definitely present. The Babinski, Oppenheim, Rossolimo and Gordon reflexes were found to be present.

Final Result.—By practice and experience the patient was, to a certain extent, able by taking advantage of his own defense reflex movements and consequent rigid and fixed position of his lower limbs, to utilize these movements in assisting himself to changes in position. While sitting in a wheel chair he was able to clear his thighs and buttocks from the seat of the chair, the knees being rigid and the ankles fixed for support. In this manner by a pulley arrangement above his bed he was able to clear himself from his chair, swing on to the bed and content himself with the idea that he had a certain return of motion more or less voluntary in the affected extremities.

LITERATURE

Bastian,¹ in an article written in 1890, stated that the prevailing notion of this time was that in man, after a total transverse lesion of the spinal cord, the reflexes were exaggerated below the lesion following the period of shock. This notion was based on the experiments of physiologists. Bastian's contention, based on his own personal experiences in cases of transverse softening of the cord and references to the literature of the subject, was opposed to this view. In 1882, in an article in Quain's Dictionary of Medicine (page 1480) he had already expressed a very definite opinion on this subject, based on an observation of three cases of total transverse lesions of the cord (softening). In his later article he reported four cases with verification by necropsy and study of ascending and descending degenerations. In this series the longest period of duration of the paralysis was seventeen weeks. Bastian states that, although there was not in all of these cases a record of the condition of the reflexes up to the termination of the illness, his memory enabled him to say most definitely that the limbs in all remained in a condition of flaccid paralysis with no signs of rigidity even up to the end. This condition of areflexia with flaccidity and sensory paralysis was hereafter known as Bastian's Law in complete lesions of the cord. The explanation of the phenomenon was that the autonomy of the spinal cord decreased as we ascend the vertebrate scale; and that further loss of pain sensation was the determining factor which brought about the loss of reflexes. This loss included both the cremasteric and abdominal reflexes. It is, however, interesting to note that Bastian admitted the persistence in the plantar reflex and also to a certain extent the vesical and rectal sphincter action evidenced by the periodical discharge of urine in small quantities, and the loss of power to control reflex action concerned in defecation when this action had been strongly excited as by laxatives. Furthermore, the persistence of the idiomuscular contraction due to mechanical stimulation was noted, but explained as not being a true reflex.

Bastian's Law, accepted by Ludwig Bruns² and sometimes called the Bastian-Bruns Law, was, however, the subject of considerable controversy. Oppenheim,³ in his textbook (1913), and particularly Lapinsky,⁴ who gives a large bibliography on the subject and his

1. Bastian, H. Charlton: On the Symptomatology of Total Transverse Lesions of the Spinal Cord, Tr. Royal Med. and Chir. Soc., London, **73**:151, 1890.

2. Bruns, Ludwig: Arch. f. Psychiat., **25**:759, 1893.

3. Oppenheim, H.: Lehrbuch der Nerven-Krankheiten, **1**:136, 1913.

4. Lapinski, Michael: Arch. f. Psychiat., **42**:55, 1906.

own personal experiences on clinical observations and animal experimentation, discusses the various observations and opinions. This latter author and Henneburg,⁵ also Kausch⁶ (1901), reported cases of complete transverse cord lesions above the lumbar enlargement which were followed by preserved tonicity and tendon reflexes and appeared definitely to contradict Bastian's Law. Previously, certain observers had intimated that skin reflexes were persistent—but few, if any, undisputed cases of preserved tendon reflexes were reported. Jolly,⁷ however, also reported such a condition. The condition described by Bastian appeared to be explained then by lesions affecting directly the reflex centers, shock, extensive alterations in the cord, blood and lymph circulation disturbances, tearing of posterior roots, increased cerebrospinal fluid pressure, or chronic degenerative changes in muscles, peripheral nerves, ganglion cells or posterior roots.

RECENT CONTRIBUTIONS

Since the beginning of the great war there have appeared numerous observations of complete traumatic transverse cord section, and in the great interest which attaches to the clinical manifestations of this condition there have been many careful and detailed reports. Of these observations, the following may be mentioned:

Observation of Dejerine and Long⁸: Cervical paraplegia of traumatic origin, motor and sensory paralysis below the lesion, abolition of tendon reflexes, conservation of cutaneous reflexes. The plantar reflex occurred in this case always in flexion which was interpreted by Dejerine to mean that the pathologic extension reflex of the great toe was not conditioned solely by pyramidal tract degeneration, but for its production an intervention of superior centers was necessary, such as cortical, subcortical and mesencephalic centers.

Observations of Dejerine and Mouzon⁹ covered seven cases: in all but one, absence of tendon reflexes. Preservation of defense reactions and cutaneous plantar reflex. This plantar reflex was in flexion confirming Dejerine in his previous notion of the supermedullary factor in the production of the extension reflex of the great toe. Report of a further patient (Case 10) presenting crossed defense reflex reactions.

5. Henneberg: *Charité—Ann.*, **31**:161, 1907.

6. Kausch: *Mitteilung aus den Grenzgebieten der Med. u. Chir.*, **7**:541, 1901.

7. Jolly: *Neurol. Centralbl.*, **21**:334, 1902.

8. Dejerine and Long: *Soc. de Neurologie, Seance du 12, Decembre, 1912, Rev. neurol.*, **24**:769, 1912.

9. Dejerine, James A., and Mouzon, J.: *Sur L'Etat des Réflexes dans les Sections Completes de la Moelle Epinière, Rev. neurol.*, **28**:155, 1914-1915, *ibid.*, 201.

Observation of Gustav Roussy:¹⁰ Total destruction in the region of the lumbar enlargement of cord in two cases. Flaccid paraplegia with anesthesia and loss of defense reactions and cutaneous reactions.

Observation of Claude and Petit¹¹—three cases: Absence of all reflexes, complete anesthesia below the lesion. The longest duration of life after injury was one month and three days.

Observation of Claude and Lhermitte:¹² Destruction at the eleventh dorsal segment. Duration of life after injury, 136 days. Preservation of tendon and skin reflexes. The plantar reflex was in extension, but later changed to flexion.

Observation of Guillain and Barre¹³—fifteen cases: Longest duration of life was forty-one days—in most of the cases, considerably shorter. In all but one, loss of tendon reflexes, plantar reflex, flexion of great toe. Defense reactions present in but three cases.

Observation of Head and Riddock¹⁴—eight cases: Divides the course which the cases run into three stages: 1. Stage of flaccidity. 2. Stage of reflex activity. 3. The stage of gradual failure of reflex functions. The contents of the bladder and rectum may be voided automatically. A widespread reflex action consisting of flexor spasm of lower extremities, abdominal wall, evacuation of bladder and sweating is designated as "mass reflex" in complete section. The flexor muscles in all phases show more tone than do their antagonists. Comparing the manifestations of complete and incomplete lesions, the authors state that there are no manifestations by which we can be certain that the spinal cord has been anatomically divided. But certain manifestations were found in incomplete lesions, not occurring in complete lesions; of such, noteworthy were the difference in character of flexor responses as compared with the "mass reflex"; a slower relaxation phase in the knee jerks; no obvious tonus difference in flexor and extensor groups; and especially the presence of extensor responses designated as postural reflexes, dependent on the integrity

10. Roussy, Gustav: Deux Cas de Section de la Moelle par Plaie de Guerre suivis d'Autopsie, Soc. de Neurologie, Seance du 5, Novembre, 1914, Rev. neurol., **28**:206, 1914-1915.

11. Claude et Petit: Trois cas de Section Complete de la Moelle Epiniere par Balle, Soc. de Neurologie, Seance du 3, Decembre, 1914, Rev. neurol., **28**:217, 1914-1915.

12. Claude et Lhermitte: Les Reflexes Tendinaux et Cutanes, les Mouvements de Defense et d'Automatisme dans la Section Totale de la Moelle d'apres une Observations, Anatomo-Clinique Ann. de med., **3**:407, 1916.

13. Guillian et Bare: Etude Anatomo-Clinique de Quinze Cas de Section Totale de la Moelle, Ann. de Med., **4**:178, 1917.

14. Head and Riddoch: The Reflex Functions of the Completely Divided Spinal Cord in Man, Compared with Those Associated with Less Severe Lesions, Brain, **40**, Parts 2-3, 1918.

of certain descending propriospinal paths. Examples are homolateral or bilateral extension of the lower extremities by stimulation of upper receptive fields or by gently pressing on the sole when the limb is passively flexed (extensor thrust). Further, in these cases of incomplete division, muscular action of the ipsilateral limb is diphasic in character (flexor and extensor) as compared with the undiphasic type (flexor) as seen in complete lesions. In certain cases of incomplete lesions the action is comparable to the steppage movement of the spinal dog. Tonus of all the muscles is constantly below normal in the resting state after total transection.

Two important articles on spinal injuries in warfare have recently appeared by Holmes and by Collier. Gordon Holmes¹⁵ is of the opinion that in total transverse lesions of the cord the knee and ankle jerks are probably permanently absent. Preservation of tone in the muscles is an indication that some improvement may be expected. The amount of reflex movement obtained by stimulation of the soles varies more or less inversely with the severity of the injury. In less severe lesions, in the early stages, he speaks of a unisegmental reflex of flexion of the toes, or flexion of the toes associated with contraction of the hamstrings by stimulation of the receptive field of the first sacral segment in the sole.

James Collier¹⁶ postulates four consecutive stages of plantar reflexes following a transverse cord lesion: "1. An initial extensor response. 2. Either a complete absence of any reflex which may be the result of shock or of isolation alteration, or a reduced flexion reflex which is the result of isolation alteration coming on rapidly. 3. The extensor response which when persistent is indicative of a less severe lesion or alternatively of more recovery than the reduced flexion reflex. 4. The normal reflex which returns when recovery is complete."

COMMENT

The case reported in this paper is a striking example of spinal automatism after cord transection. It is noteworthy particularly because of the following considerations:

1. Long duration of life (patient is still alive, September, 1918).
2. Persistence of the extensor toe reflex.
3. Exaggerated patellar and ankle jerks.
4. Patellar clonus.
5. Automatic bladder and rectum.

15. Holmes, Gordon: Goulstonian Lectures, *Brit. Med. Jour.*, 2:769, 815, 855.

16. Collier, James: Gunshot Wounds and Injuries of the Spinal Cord, *Lancet*, London, 1:711, 1916.

6. Preserved muscle tonus of normal or increased degree. This state of tonicity is emphasized by the constant tendency to extension of the great toes in the resting stage, there being no contractures or joint complications present.

7. Presence of extensor as well as flexor responses in the same extremity. Head and Riddock report contralateral extensor responses accompanying flexor movements in one extremity. Such contralateral responses, although not searched for, were not noted in this case.

8. Concomitant flexor and extensor responses of unequal intensity in the muscles of the same extremity. This observation would be in opposition to the theory of reciprocal innervation of antagonistic muscles. Tilney has recently stated (personal communication) that in physiologic experimentation, myographic tracings of flexor and extensor groups of an extremity when the whole limb is set into action appear to throw some doubt on the correctness of this theory.

NEUROPSYCHIATRY IN RECRUITING AND CANTONMENT *

M. S. GREGORY, M.D.
Major M. C., U. S. Army

NEW YORK

The topic assigned to me is neuropsychiatry in recruiting and cantonment. However, as my experience has lain chiefly with the latter, I shall confine my remarks to neuropsychiatric examinations in the cantonment.

The neuropsychiatric work in the cantonment presents special features which are quite different from those in military hospitals. In the latter, neuropsychiatry is similar to that in civil hospitals, or civil practice.

In base hospitals, one finds obvious disorders, chiefly. These have been referred for examination and treatment, by the regimental surgeons, who are, as a rule, not very familiar with such conditions.

In the cantonment, the same class of cases is met with, but, in addition, one encounters a special type, which rarely, if ever, finds its way to the base hospital, by reason of the fact that the true character of such disorders is not recognized and very frequently they are regarded as entirely foreign conditions, such as malingering, carelessness, shiftlessness, delinquency, inattention to duty, etc.

TYPES OF DISEASES OBSERVED

It is scarcely necessary to burden you with the statistics, which would not essentially differ from those already given, and are not dissimilar from those found in civil life, only modified by the natural differences, such as age, sex, climate, geographic conditions, care in selection, etc. Suffice it to say that one encounters gross organic nervous diseases, such as early tabes, paresis, multiple sclerosis, peripheral neuritis, neurosyphilis, residual from old poliomyelitis, occasional brain tumor and other conditions on the one hand, and, on the other, well developed dementia praecox, manic-depressive psychoses, mental deficiency, alcoholism, drug addiction, epilepsy and well marked psychoneuroses.

* Submitted for publication Oct. 30, 1918.

* Read as a part of symposium at the Annual Meeting of the American Neurological Association, Atlantic City, N. J., June 9, 1918.

* Authority for publication granted by Board of Publications, Surgeon-General's Office.

Between these two extremes, there is a host of intermediary conditions, such as mild neuroses and psychoneuroses, neurasthenias, anxiety states, hysterias and hysteroid episode, epileptoid conditions, psychopathic personalities, inferiors, military misfits, conscientious objectors and otherwise near-normal individuals. This group of cases is, of course, the most baffling and taxes the ingenuity and resourcefulness of the examiner to the utmost. Moreover, they constitute a greater menace to the military organization by lowering the efficiency and impairing the general morale, than do the obviously diseased types which are readily recognized and without great difficulty eliminated. They are a constant source of annoyance and trouble to the officers, forming the larger number of the absentees, the discontented, the inefficients, the inmates of the guard house and the frequenters of the regimental infirmary.

These are the cases which complain of being dizzy, faint and bewildered at critical moments, while in training or maneuvers.

The psychoneurotic forms the largest and most important of this intermediary group. As they present themselves in the cantonment, and based on the duration and mode of onset of their malady, they may be classified, for practical purposes, into three groups:

The first group consists of those in whom the disease existed long before their entrance into the Army. These, as a rule, have neuropathic family history and have been unstable and more or less shiftless, long prior to the onset of the neurosis. Curiously enough, many of the neurotics of this type are found among the enlisted men who have been advised to enter the Army by physicians, with the assurance that the discipline and outdoor life would correct their trouble. Others have enlisted without such advice, although they themselves have entertained the hope that they would derive benefit from military service. According to their own statements, all seem to have felt quite improved for a short period immediately after their enlistment. However, this amelioration has been of brief duration. My personal experience has been that this type of neurotic is quite unfit for military service and that the entrance of such individuals has been detrimental to themselves as well as to the Army.

The second group comprises those in whom the disease arises while they are in the Army, following an accident, injury or some somatic disorder, such as rheumatism, bronchitis, etc. The neurosis is referred to and intimately connected with the injury or disease. These men, as a rule, have a better family and personal history than the former group and recovery of a small proportion may be looked for in camp.

The third group is made up of men whose antecedents have been apparently free from neurotic taint and in whom the hysterical conversion has not been definitely established, remaining latent or just beneath the surface and usually corrigible by educative and environmental influences.

AUTHOR'S OBSERVATION REGARDING MALINGERING

Most of the neurotics have been regarded as malingerers. Some of them part of the time and many all of the time. Without going into the general question of malingering, I should like to state that my experience has been at variance with that of some others. In the examination of thousands of cases, I have been able to convince myself that malingering, pure and simple, could be established in only four cases. Three of these simulated mental disease and one epilepsy. Of course, most of the psychoneurotics consciously exaggerate their symptoms, which largely contributes to the erroneous notion that they are malingerers. Careful examination and analysis of most of these will, however, reveal a pathologic background.

METHODS OF APPROACH

Before going into the discussion of the very mild and borderline cases, I should like to make a few observations as to the method of approach in neuropsychiatric examinations in cantonments. Of course, one hardly expects to be received with enthusiasm when one arrives at a camp to do neuropsychiatric work. There appears to be, on the contrary, with very few exceptions, a lack of interest, or an indifference, or a manifest skepticism; not infrequently there is a passive, or even an active antagonism to any examination of this sort. Strangely enough, the medical officers are the chief passive obstacles, and in the beginning, very little assistance or cooperation can be obtained from them. So, the first effort at a cantonment must be directed to the officers, especially the medical officers, with the view of demonstrating to them the practical value of such examination, in order to enlist their sympathy and cooperation. They must first be made to appreciate the importance of neuropsychiatric examinations. In order to accomplish this, one frequently has to resort to tact, persuasion or even strategy.

In dealing with this situation of passive resistance, it is desirable in the beginning to report as unfit for military service only those men with obvious nervous or mental disturbances, and in whom one can show the disorder in its early phases and point out how the disease influences the soldiers' conduct and efficiency. For example, the painstaking demonstration of an early case of tabes, of disseminated scle-

rosis, of paresis, of dementia praecox or of manic-depressive psychosis, which has been unrecognized and unsuspected, will go a great way in rousing the interest and even the enthusiasm of the medical officers. The greatest help to the neuropsychiatrist comes, however, from the line officer, and particularly the company commander. It may seem strange, but it is, nevertheless, true, that the line officers appreciate the value of neuropsychiatric examinations much more readily than do the medical officers.

The explanation for this may be found in the fact that the line officer rates his men in terms of conduct, behavior and efficiency, which, after all, is equivalent to the standard of the neuropsychiatrist who estimates conduct from the mental qualities and make-up of the individual. If a company of soldiers be carefully examined from the neuropsychiatric standpoint, and the results compared with the reports furnished by the company commander of those men in his organization who have been inapt, inefficient, slow, awkward, easily fatigued, delinquent, insubordinate and difficult to get along with, a striking parallelism will be found between the two sets of observations.

Experiences of this character naturally bring the line officer very close to the neuropsychiatrist. The officer eagerly seeks counsel and aid, as he at once recognizes that both he and the examiner are dealing with similar problems. The neuropsychiatrist may be called on by the commanding officer to give advice in the matter of discipline of the force and even in the rating of the efficiency of his officers, etc.

VALUE OF EDUCATIONAL PROPAGANDA

In addition to all this, educational propaganda in the way of popular talks and discussion, will render the work of the neuropsychiatrist much more agreeable and profitable in a military camp. I have referred to this matter perhaps at some length, for the purpose of introducing the subject of applied psychiatry, or preventive psychiatry if you choose, which is, I believe, the most important phase of neuropsychiatric work in the Army.

It must be remembered that in a hastily formed army like ours, especially under a system of draft, there is a great demand on the individual soldier for a rapid and violent adjustment. Men without any previous military experience, drawn from every walk of life — from distant parts of the country, from farm and factory, bank and bench — the rich and the poor, the illiterate and the educated — all are thrown together in a heterogeneous mixture and subjected to the same discipline, the same regulations and the same daily routine.

It is most astonishing how well and how rapidly they adapt themselves under these most difficult conditions. However, there is a small

number in whom this adjustment does not readily take place. It is among this class of men that one observes pathologic reactions, in the form of sluggishness, discontent, inadaptability, lonesomeness, nostalgia, lack of application, lack of initiative and ambition and, therefore, military inefficiency. Some of these, of course, are of markedly pathologic makeup, but the great majority are men to whom the neuropsychiatrist can be of the greatest assistance. These are the borderline cases; the potential neurotics and psychotics, in whom preventive psychiatry finds a most fertile field.

Many patients of this kind, although able to get along fairly well in camp, suffer a definite breakdown at some critical time, such as just before embarkation; others are returned from overseas before they have seen any active service at the front. In General Hospital No. 1 we have had the opportunity of observing a number of such cases.

SUGGESTIONS AS TO PROPER SUPERVISION

What can the neuropsychiatrist do for cases of this type? It is surprising how much the advice, encouragement, assurances, personal contact and attention and trivial changes in environment will do for these men. That this is not mere theory, but intensely practical, can readily be demonstrated in a military camp or cantonment. I will give a few brief illustrations:

The attention of the neuropsychiatrist is called to a soldier who is indifferent, inefficient, lazy and seemingly lacking in initiative. Examination reveals that he comes from a large city, has had a high-school education, worked as a salesman and had a salary of from \$75 to \$100 a week. He is made assistant in the camp to a kitchen worker, who is illiterate, far below him socially and whose earning capacity has never been more than \$12 a week. The soldier does not complain of this, nor can he give any conscious reason for the change in his efficiency and conduct, which, however, he acknowledges. His commanding officer is advised to place him in another department, where his talents will find a better expression. Within a week, a striking change comes over his disposition and he is regarded as a most useful, energetic worker and a promising soldier.

A soldier serving as a waiter at an officers' mess, shows mild mental depression. He is regarded as slow, inattentive and inefficient. He complains of insomnia, nervousness, headache, dizziness and inability to take any interest in things. He is unable to assign any cause for his disability. He is anxious to be a soldier and serve his country. It is further found that he is a recent graduate of a New England college; has been brought up in affluence and comfort, and is socially equal or superior to many whom he attends as a waiter. He consciously

does not resent his position, because he feels that it is a part of military life. The commanding officer, on recommendation, assigns him to another kind of work, more in keeping with his talents and experience. He soon becomes active, energetic and efficient. He is regarded as good material for a soldier and is rapidly promoted. These are actual cases, selected from a large number, of which I have a record.

RESULTS THAT MAY BE EXPECTED

There are many soldiers who voluntarily seek the advice of the neuropsychiatrist, because of nervousness, dizziness, inability to sleep, poor appetite, indefinite pains, etc., and who, with marvelous rapidity, yield to treatment by the "nerve specialist" of the camp. The amount of effective effort which can be achieved in applied neuropsychiatry in the Army, is only limited by the experience, interest and ability of the neuropsychiatrist.

Work of this kind in a camp is extremely fascinating and stimulating. The neuropsychiatrist is no longer one who merely selects obvious cases of nervous and mental disease for elimination from the Army, but also one who heals, repairs, conserves and reconstructs. He becomes the guardian of the mental health, just as the sanitary surgeon is responsible for the physical welfare of the military organization.

If work of this kind is profitable in a camp or cantonment, how much more essential must it be at the front, where nervous tension, hardship and trying conditions of all kinds tax to the uttermost the endurance of the soldier. I think I am not speculating when I say that efforts along this line would be one of the most effective measures in lessening the incidences of nervous breakdown or so-called "shell shock."

It was in part, I believe, with this view, that the position of division neuropsychiatrist was created — one of the most important and far reaching achievements of the neuropsychiatric department of the Army, for which Colonel Bailey must be given the full credit.

It must be evident that work of this kind is extremely difficult, and that it is hardly a job for a novice or a young physician, however excellent his technical training may have been. It requires men of mature years, ripe judgment, with personal prestige, which can only come from many years of accumulated practical experience. This is one of the reasons why it is hoped that the leaders in neurology and psychiatry may be induced to enter the service.

THE GENERA IN CERTAIN GREAT GROUPS OR ORDERS OF MENTAL DISEASE *

E. E. SOUTHARD, M.D.

BOSTON

I want to present to the American Neurological Association certain amplifications of material presented in 1917 as a key to the practical grouping of mental diseases. Under the eleven groups of mental diseases defined in 1917, I wish to place such practical subdivisions as seem to me confirmed by American psychiatric experience.

As I find that many persons hardly distinguish between a classification and a key and labor under the impression that I am trying to erect a novel classification of mental diseases, let me insist that I am proposing nothing but a key to the classification of mental diseases according to the entities which I find in common diagnostic usage. I am elsewhere insisting on the extraordinary unanimity which American psychiatrists are now displaying on the matter of psychotic entities. There is, in fact, hardly enough controversy to indicate a healthy progress in the matter of theoretical psychiatry. (There is, to be sure, one large controversy concerning the nature and dimensions of psychogenesis and the part it may play in sundry mental diseases; but this controversy has to do with more general aspects of psychiatry than the question of its contained psychotic entities. Nothing is more hopeless than a discussion, for example, of psychogenesis in dementia praecox when the controversialists do not agree as to the clinical symptomatology of the cases under discussion.) This unanimity of view as to the psychotic entities of modern psychiatric science is so marked that a committee of the American Medico-Psychological Association has been able to formulate an acceptable list of such entities now in process of adoption by most of the institutions for the insane in the country. The progress in mental hygiene secured by this universal adoption of a list of psychotic entities is certainly a subject for congratulation.

PURPOSES OF THE AUTHOR'S INVESTIGATIONS

What I have been attempting of recent years on the basis of the diagnostic sifting-machine material afforded by the Psychopathic Hospital is to study the logical processes of psychiatric diagnosis and to

* Submitted for publication Oct. 30, 1918.

* Read in abstract at the Annual Meeting of the American Neurological Association, Atlantic City, N. J., May, 1918.

find, if possible, some simpler ways in which to arrive logically at one or other of the psychotic entities which we virtually all agree on.

I have placed some larger considerations on this matter of the "process-types" of diagnosis in a paper read this year before the Association of American Physicians, to be published in the *Journal of Clinical and Laboratory Medicine*. The paper is entitled "*Diagnosis per Exclusionem in Ordine*: General and Psychiatric Remarks." I do not need to rehearse the points of this paper before the American Neurological Association. I was, in fact, trying to read something of a lesson to the diagnosticians of the eminent internist group represented by the Association of American Physicians, calling to their attention the need for more elaborate logical methods of approach to diagnosis in psychiatry than in many branches of medicine. Some of the elders amongst the internists had for years denounced the method of diagnosis by exclusion; one of them said that the method was bound to fail because of our ignorance of pathology and went on to say that diagnosis by exclusion was a tedious method. Of course, tediousness ought not to stand in the way of accuracy, and pathology is bound to remain imperfect for many decades, not to say centuries. The fact is that in fields of diagnosis where there are no indicator symptoms, the method of diagnosis by exclusion is unconditionally necessary; for, in the absence of an index of differentiation or indicator symptom (or "presenting symptom" as Dr. Richard Cabot sometimes calls it), the diagnostician is bound to take into account all forms of mental diseases when he is trying to eliminate and differentiate the particular psychosis displayed by his patient.

Hence, I went into some detail in the paper mentioned, on a method of diagnosis which I called *diagnosis per exclusionem in ordine*. The central part of the idea had already been presented in the paper entitled "A Key to the Practical Grouping of Mental Diseases," presented before you in 1917.

The advance which I want to make this year is implicit in the method of the key presented last year. Last year I suggested that the tyro in diagnosis might well consider and exclude in sequence the great groups of mental diseases A, B, C, D, etc. I put A before B, B before C, etc., simply because the methods of diagnosis in Group A appealed to me as more certain, practical and general in their scope than the method available for Group B; the same for the methods of Group B as against those for Group C, etc.

This year I want to set down the subgroups of mental diseases which it seems to me practically all of us admit exist (if we admit that any entities whatever exist), in a proper diagnostic order. I want

to extend the principle of orderly diagnosis, that is, of *diagnosis per exclusionem in ordine* (genera) under groups (orders, in the botanical or zoological sense). Now I must acknowledge at the outset that the farther we go into detail, the less unanimity must a priori be expected in the psychiatric world. Accordingly, I would concede that my proposals are bound to be far less acceptable in their details than the proposals in the more general key to the main orders of mental diseases presented in 1917, but if the principle of exclusion in order be accepted for practical diagnosis, then I shall have no quarrel with those who feel that the entities are too many, too few or even non-existent.

IMPORTANCE OF GROUPING DISEASES

One more general remark: I feel that the history of modern developments in logic indicates that the part of order is the one part which has undergone great developments in recent years. We have discovered that though we cannot always measure things, we can sometimes put them in order unmeasured. It seems to me that the development of orderly diagnosis is quite on the carpet for modern workers. It may not be superficial to say that expert diagnosticians may not need to employ the method of diagnosis by exclusion in order simply because the facts in a given case may immediately suggest to them (by processes of mere inspection or of very rapid comparison) the right diagnosis. Time and again, however, the best experts fail in their attempt to apply the methods of diagnosis by inspection and by comparison, and surely the inexpert youthful psychiatrist needs some key to guide him. How frequently in the clinic do we find that the youthful diagnostician is by very little emphasis here and there able to press the phenomena of his case either into the dementia praecox or the manic depressive group or into the senile or the focal brain disease group, respectively. The point of this difficulty lodges in the fact that there are practically no indicator symptoms in mental diseases, and actually any symptom you may specify is quite able to lead you in any one of the main diagnostic directions. Let a young diagnostician of the dogmatic or slightly paranoid type get the initial idea that a case belongs in the dementia praecox group, he will be able to defend his thesis against all comers by the use of symptom lists founded on the very best textbooks; in fact, the better the textbook the easier for the young tyro to carry his point — for the time being.

Following are tabulated suggestions for the generic classification of mental disease groups, each group followed by some general remarks.

I. SYPHILOPSYCHOSES* (the syphilitic mental diseases):

Genera:

General paresis

Juvenile paresis

Nonparetic forms:

Meningitis

Vascular

Gummatous

Less common genera:

Syphilitic feeble-mindedness

Syphilitic epilepsy

Tabetic psychoses

Syphilitic paranoia

Of course, the syphilopsychoses are by no means coterminous with neurosyphilis. The term neurosyphilis generally taken, must be supposed to include both the syphilopsychoses and the syphiloneuroses. The systematist will find a certain difficulty in placing many forms of neurosyphilis amongst the psychoses and the neuroses, respectively. We are here dealing with the psychoses, and our classification does not include the neuroses.

If one were asked how to distinguish the syphilopsychoses from the syphiloneuroses, one would have to reply on practical grounds that, if the case showed psychotic symptoms, it should be placed among the psychoses even if there were also present, is usually the case, a number of neurotic symptoms. In short, owing to their practical significance, psychoses might be supposed to have the first call in classification as against neuroses. On this account the disease commonly known as general paresis would fall amongst the syphilopsychoses, despite the existence therein of any number of symptoms pointing to nonpsychical part of the nervous system. On the other hand, the disease commonly known as tabes dorsalis would best be placed amongst the organic neuroses, despite the appearance in tabes from time to time of a few mental symptoms. If, however, a case of tabes develops symptoms of a paretic nature, then the common rule is to term the case one of taboparesis. If in the course of the tabes certain characteristic excitements with hallucinations appear, then we have a rare entity known as tabetic psychosis. I am not sure that there has even been a well established case of this disease, tabetic psychosis, in the Psychopathic Hospital clinics amongst 10,000 admissions. So much for the general relation of the syphilopsychoses to the syphiloneuroses.

The issue is a practical one, and decision is made on the appearance of psychotic symptoms in the case. If these dominate the scene, then

* Re-syphilopsychoses: Dr. Solomon and I in a recent case-book tried to bring order into the nomenclature of neurosyphilis by reducing the main forms thereof to:

(a) Paretic

(b) Tabetic

(c) Diffuse

(d) Vascular

(e) Gummatous

(f) Juvenile

the case should in my opinion be termed syphilopsychotic. Of course, if the syphilitic infection precedes and in a psychogenic way occasions a neurasthenia, then from this point of view we should not be dealing with a case of syphilopsychosis, but with a case of psychoneurosis. If, as in one of the war cases, a syphilitic infection appears to bring about an epilepsy, we are not dealing according to this grouping with an epilepsy which is syphilitic, but an epilepsy presumably brought about in some psychogenic way and only indirectly due to the operations of spirochetes. These two exceptional diseases might be then named psychoneurosis syphilogenica and epilepsia syphilogenica, in which we place in the adjective the exciting factor and place in the abstract noun the general nature of the disease in question.

Syphilopsychoses, then, are diseases in which the psychosis is essentially spirochetal. Where the spirochete acts after the fashion of an occasioning factor, it would seem wiser in the interests of the patient to place the disease elsewhere.

A note on the order in which the genera under the syphilopsychoses have been placed is in point. I have placed, in the foregoing grouping, general paresis first because it seems to me that the means for its diagnosis are more exact and reliable than the means for the diagnosis of the other forms of syphilopsychosis.

I have placed juvenile paresis second, hoping that the systematic examiner of cases of this group will consider very early in his logical work the question of congenital neurosyphilis. It has seemed to us at the Psychopathic Hospital that a good many errors in diagnosis have been made by the lack of consideration of congenital factors. These errors do not stand out so strongly in district state hospital material as in Psychopathic Hospital material.

The third genus or group of genera under the syphilopsychoses is constituted by the nonparetic forms. Despite the difficulty of the mutual differentiation of this group, I am inclined to separate the genera as indicated into meningitic, vascular and gummatous. To define a genus through negative features is a device which should not be resorted to except in extremity. Accordingly, I hold that the diagnosis cerebral syphilis, cerebrospinal syphilis, as made in many of our clinics, is as a rule no more exact than the more general diagnosis neurosyphilis. When this diagnosis is rendered, there are often no prognostic data available. As a matter of fact, as pointed out by Solomon and myself in the book previously mentioned, much damage may be done to a patient by terming him either general paresis or cerebrospinal syphilis at a time when it is strictly impossible to tell to which genus of the order syphilopsychoses the patient really belongs. At a little later stage in diagnosis, when more data have been collected, it is

virtually always possible, especially with the laboratory data now available, to indicate whether one regards a case as meningitic, vascular or gummatous. Why then, should we stop with the diagnosis "cerebrospinal syphilis," which amounts to little more than the statement that a man has either syphilopsychosis or syphiloneurosis, when we can profitably permit ourselves a generic diagnosis which may indeed practically help the patient a good deal.

Accordingly, I hold that general paresis, juvenile paresis, meningitic, vascular and gummatous syphilopsychoses form fairly well recognized genera in the order of syphilopsychoses. I do not propose a nomenclature, however, for these genera, hoping to excite a critique on the matter.

In addition to these five more or less readily distinguished genera under the order syphilopsychoses, there are a number of less common ones.

Shall we term syphilitic feeble-mindedness a form of feeble-mindedness or shall we term it a form of syphilopsychosis? According to the general principles of diagnosis by exclusion in order and in the pragmatic and therapeutic interest of the patient, I very much prefer to have the disease classified under the syphilopsychoses. Order Number ii, that of the hypophrenias, is made to include practically all kinds of feeble-mindedness which have been defined. Why then should we not speak of a hypophrenia syphilitica? Would it not help the specialists in feeble-mindedness so to classify their material? From that more limited standpoint I should agree that hypophrenia syphilitica might be a proper term for the somewhat rare disease, but from the standpoint of neurologic clinics, neurologic and psychiatric clinics, district state hospitals, psychopathic hospitals, I would still think it best to insist on the pragmatic side of the situation by regarding this disease as one amongst the syphilopsychoses. It might be termed neurosyphilis hypophrenica.

Identical considerations hold for syphilitic epilepsy; in fact, it seems to me that the considerations are here stronger; for it is certainly much more definite to term a condition neurosyphilis epileptica than it is to call it epilepsia syphilitica. From the more limited standpoint of the epileptologist, of course epilepsia syphilitica may approve itself, but epilepsy is so much broader and vaguer a concept that it seems to me highly worth while to place all cases of epilepsy regarded as syphilitic in origin amongst the cases of neurosyphilis.

I called attention in the foregoing to one of the war cases in which the acquisition of a syphilitic infection brought out an epilepsy: that case presumably belonged neither in the syphilopsychoses nor in the epileptoses, but rather amongst the psychogenic cases which we rele-

gate to a much lower place on the scale. Such a case might very possibly be classed in the genus hysteria, of the order psychoneuroses. If we hold the diagnostician down in such a case to an exact definition of what he means by making him specify the genus or order in question, we shall greatly improve our logical technic in diagnosis. For instance, is the case one of syphilopsychosis epileptica? Then we would suppose that the spirochetes were in some way acting on the brain so that a true epilepsy hardly distinguishable from sundry other organic forms was being produced. Or, is the case one of hysteria epileptica or hysteria epileptoides in which the adjective conforms with the degree of doubt concerning the observed phenomena themselves? Under the latter circumstance a quite different genesis is to be suspected at work. But, you will reply, how often are we unable to tell which form of genesis is in play? Quite right, one must reply, but until one knows what form of genesis is in play, the true or indicative diagnosis, the really pragmatic diagnosis which will help treatment, has not been rendered.

It seems to me that the diagnostic sheets and statistical tables of many clinics are full of these hedging diagnoses.

As for other less common genera, tabetic psychosis and syphilitic paranoia, something has been said in the foregoing concerning tabetic psychosis (note again that we do *not* mean by tabetic psychosis that subform of general paresis called tabo-paresis); and I shall not delay on syphilitic paranoia, an exceedingly rare genus if it at all occurs.

Under the term atypical, as under other orders of mental disease, I propose to leave room for syphilitic mental diseases of doubtful or hitherto undefined nature, for it is no part of the present endeavor to enumerate and fixate a nomenclature for the psychoses. As in several places stated, I am simply trying to take the groups which modern clinics recognize and place them in a practical diagnostic sequence.

II. HYPOPHRENOSSES (the feeble-mindednesses, including graded forms of idiocy, imbecility, moronity (in the English nomenclature feeble-mindedness proper) and subnormals):

[Syphilitic]

Encephalopathic:

Microcephaly, hydrocephalus, focal brain.

Glandular:

Cretinism, infantilism, dysadenoidism, mongolism (?).

Hereditary:

Feeble-mindedness, amaurotic family idiocy.

Atypical.

I have placed the syphilitic group, which might possibly be regarded a good genus, under the hypophrenias in brackets. These brackets here and elsewhere are intended to indicate that the genus has been suffi-

ciently covered in the higher group to which the orderly diagnostician will have already had access.

Refer to what has preceded for notes on whether we should prefer neurosyphilis hydrophrenica to hypophrenia syphilitica. The decision is a close one. I regard it as in the practical interest of the patient to have him classified under the syphilopsychoses. One example of this sort in which an ordinary form of feeble-mindedness was found due to syphilis has been given in the Southard-Solomon collection previously mentioned; also in the Waverley Series on the Pathology of the Feeble-minded there are data which indicate that we must take into account more than in the past the question of the relation of syphilis to feeble-mindedness.

As for the nomenclature of hypophrenia, I have drawn up the arguments for the use of the term hypophrenia as against several others in the literature in a special paper which I hope will be shortly published, entitled, "Hypophrenia and Hypophrenics: Suggestions in the Nomenclature of the Feeble-mindednesses." (*Mental Hygiene*, in press.)

Passing to the genera themselves, I am inclined to think that the encephalopathic, the glandular and hereditary groups ought to be regarded as suborders or collections of genera rather than as genera themselves. I do not here propose to suggest a nomenclature for the genera themselves, but have picked out microcephaly, hydrocephalus, other forms of focal brain disorder, cretinism, infantilism, dysadenoidism, mongolism, amaurotic family idiocy and the common form of hereditary feeble-mindedness as suitable genera in the present phase of development of the theory of the feeble-mindednesses.

With some doubt I place mongolism under the glandular diseases because many workers whom I have met feel that this disease will prove to belong there.

As for the common hereditary form of feeble-mindedness, which might be named hypophrenia hereditaria, I feel that it will bulk much smaller than specialists have recently given us reason for supposing. If the encephalopathic cases are pulled to one side (regardless of their possessing tainted heredity, since it is obvious that other factors than mere hereditary germ plasm factors must have been at work), and if many of the glandular cases are set to one side as being directly due to sundry nonhereditary factors, the number of cases which we should be entitled to call hypophrenia hereditaria will be greatly diminished. A number of theoretically preventable cases of feeble-mindedness and a number of cases due to brain-destroying and body-destroying factors of a nongerm-plasm nature have been defined in recent work. Of course, the anatomists and pathologists will give

statistics that are possibly unfair to the hypothesis of germ-plasm heredity, since the anatomists and pathologists may overvalue sundry of their brain and body findings; but with all due allowance for this anatomic prejudice, certainly the number of cases of hereditary feeble-mindedness in the sense in which we use the term hereditary in the rest of medicine, is year by year diminishing with the progress of medical science.

In my paper of last year entitled, "A Key to the Practical Grouping of Mental Diseases," I endeavored to divide the hypophrenias into genera according to the quantitative results of mental tests. I am inclined to think, however, that this suggestion, however compatible with the spirit of the times with respect to the increasing accuracy of mental tests, is unsuited to the practical work of a clinic. After all, the question whether a patient is a mongolian hypophrenic is more important than whether he is an imbecile or an idiot. The same holds true for hydrocephalus and in fact for a majority of the hypophrenics. The procedure would be to determine your genus and estimate the amount of intelligence shown by the particular example in hand.

As under Group I, I have made provision by the term atypical for genera of an unknown or undescribed nature.

III. EPILEPTOSES (the epileptic group):

[Syphilitic, Group I]

[Feeble-mindedness with epilepsy, Group II]

Alcoholic	Idiopathic
Traumatic	Equivalent
Encephalopathic	Narcoleptic
Jacksonian	Borderland
Symptomatic	

Concerning the bracketing of the syphilitic and feeble-minded forms, refer to the remarks under Group II.

I will not here attempt to justify the selection of genera under the epileptoses. This is a veritable mare's nest in classification and the man who wishes to use a classification by putting the elements in order of consideration is greatly at a loss. Practically it has seemed to me that if one could push on one side early the alcohol and traumatic question that one would come down on the questions of brain tumor, etc., with a great deal more confidence than if one started in with the latter. Also, practically there are many questions concerning the proper classification of all sorts of diseases having convulsions. The pragmatic answer to the question whether a given disease should be classified under epileptoses or under some other group depends, it seems to me, on the kind of treatment which you propose on your basis of analysis to give the patient. If the kind of treatment is nothing but the regimen, custodial or otherwise, which you prefer for epileptics in general, then the case should be classified amongst the

epileptics. If, however, the convulsions are incidental in some bodily disease, or even in some brain disease in which special surgical treatment or other special treatment may be indicated, then it seems to me that we do the patient a pragmatic injury by classifying him among the epileptics and not in some more definite group of diseases. On this line refer to the remarks concerning epilepsy in syphilis under Group I.

The thumb rule would be: Never classify a case as epileptic if you can be more definite as to its nature and especially its cause.

IV. PHARMACOPSYCHOSES (the group of mental diseases due to alcohol, drugs and poisons):

[Epileptic, Group III]

Alcoholic

A. Pseudonormal:

Drunkenness, pathologic intoxication, dipsomania

B. Peripheral-Central:

Delirium tremens, hallucinosis, Korsakow, pseudoparesis.

C. Central:

Jealousy-psychosis, paranoia (?), dementia

Drug:

Morphin, cocain, alkaloid

Poison:

Lead, gas, mercurichlorid, special

I will not pause to discuss the details under Group IV. It would seem to me that the designation pharmacopsychoses is a good one, as the Greek word on which the term is founded can be used for both drugs and poisons.

A great deal of theoretical interest attaches to the nature as well as to the diagnosis of the subforms of alcoholic psychoses. I have cast these into three groups, rather inadequately termed pseudonormal, peripheral-central and central. My point is that ordinary drunkenness and so-called pathologic intoxication and dipsomania form three conditions which are, if not normal, then distinctly less abnormal than the other diseases. Drunkenness, it may be stated, is not a form of insanity, and many legislators have so determined, but that drunkenness is not a kind of psychosis I think hardly any one would deny. Here is an instance in which the distinction between a mental disease and insanity comes out very clearly.

But is it possible to distinguish the peripheral-central group from a central one? Practical workers, it seems to me, would agree that delirium tremens, alcoholic hallucinosis, Korsakow's disease and the so-called alcoholic pseudoparesis (if this latter disease at all exists) more closely resemble one another than they do in any of the other forms of alcoholic mental disease. If some one could provide a good designation for this small fraternity of alcoholic disease genera which I have called peripheral-central, he would help our practical work a

good deal. I find a good deal of almost useless discussion in early phases of observation of alcoholic cases as to whether they are instances of delirium tremens or alcoholic hallucinosis. I do not wish to deny a generic value to the distinction, but if we could halt our diagnostic process at the point where the observations stop, we should help psychiatric diagnosis not a little.

The third group that I have termed "central" is composed of the jealousy psychoses which most workers acknowledge that they find in certain instances, paranoia (a much more doubtful matter) and dementia. Here are diseases in which the peripheral element, histologically and symptomatically, is far less in evidence. To be sure there may have been some element of a peripheral nature in the disease at some time, but the chances are that such cases with strong peripheral element belong in the peripheral-central group rather than in the central group. An exact and elegant nomenclature would be a bonanza for practical workers among the pharmacopsychoses.

V. ENCEPHALOPSYCHOSES (focal brain lesion group of mental diseases):

- [Syphilis]*
- [Feeble-mindedness]*
- [Epilepsy]*
- [Alcohol, gas]*

Traumatic. Note that the traumatic neuroses, although they form a group of mental diseases, belong not here in Group V, but below in Group X, the psychoneuroses.

Neoplastic.

Infectious. The infectious group of encephalopsychoses here listed refers to cases like brain abscess and meningitis in which the organism has produced local destructive effects in the brain.

Vascular. Under this group would fall the great group of arteriosclerotic dementias which, be it noted, are parted out from the old age psychoses; Group VIII, below.

Degenerative.

VI. SOMATOPSYCHOSES† (the so-called symptomatic group of mental diseases):

- [Glandular feeble-mindedness]
- [Symptomatic epilepsy]
- Infectious, e. g., typhoid
- Exhaustive, e. g., puerperal
- Metabolic, e. g., cardiorenal
- Glandular, e. g., thyrotoxic
- Pellagrous

* These have been classified, respectively, under syphilopsychoses, Group I; hypophrenoses, Group II; epileptoses, Group III, and pharmacopsychoses, Group IV.

† The term "somatic" is here used following a frequent neurologic plan which employs the term "soma" for the body at large, as against the "encephalon" or brain.

I have tried to define the genera under the five subgroups here mentioned, though I assume that the progress of science will show that a symptomatic psychosis due to the typhoid bacillus is to be distinguished from a symptomatic psychosis due to the pneumococcus; but these are matters for the future to decide.

In practice one should not term a case infectious psychosis, in my opinion, unless an organism has been cultivated from the case or unless there is exceedingly strong evidence that an infection is in play. A good many puerperal cases, when organisms are cultivated therefrom, become on this basis infectious cases rather than exhaustive cases; but who would say that such a translation from one group to another would not be of benefit to the case.

Many authors speak of a toxic-infectious group, of an infectious-exhaustive group or even of a toxic-infectious-exhaustive group, but it seems to me with these double and triple designations we get on not much better than if we confine our statements to saying that the case belongs among the symptomatic psychoses. In short, we are making a very rough diagnosis and placing a case in a large group, but we are rather deluding ourselves that we are making entitative diagnosis.

When infection is not in play and when exhaustion is not in play, I can hardly see the advantage of using the term toxic. The term toxic suggests to the medical hearer that there may well be a toxin in play, that is, such a substance as may be demonstrated in the test tube or under other strictly scientific rules. If pinned down to the meaning of the term, the physician is apt to be reduced to saying that the term toxic refers to certain clinical symptoms that resemble those that are the known effects of toxins or poisons, infectious or otherwise. But is not this a retreat to ground altogether too general to be of value in diagnosis? Perhaps others will not agree with me; but when I see the term toxic and feel that there is no possible laboratory approach to the toxin-poison question, I fall into a marsh of doubt.

The third group of genera here termed metabolic is also sometimes laden with the term toxic, in fact, possibly the term autotoxic might be preferred by many to the term metabolic here used. I can see that the term metabolic is too general a term, but, on the other hand, the term autotoxic seems to specify too much.

The point in the ordering of these subgroups is that, in practical diagnosis, one ought to exclude in succession conditions in which there is a known infectious agent, conditions in which an exhaustive state without known infection, conditions of a general metabolic or autotoxic nature. Those ought to be eliminated from the scene before the glandular cases are brought under consideration.

Possibly the pellagrous group might be placed first under the symptomatic group. Indeed, in regions where pellagra is infrequent,

now and then grave errors of diagnosis have been made. I well remember that one of the first cases of pellagra which came to the Psychopathic Hospital was one of an obscure kind of depression with apparently a cyanosis of the hands regarded as a very proper vasomotor by-effect in his psychosis. By the systematic sequential consideration of these conditions, including pellagra, the question was definitely raised concerning this man whether he might not be pellagrous. The psychosis was then more carefully examined and sundry other features were brought into alignment with the manual lesions. A tentative diagnosis of pellagra was made and the patient thereafter developed a classic form of the disease.

VII. GERIOPSYCHOSES* (the presenile-senile group of mental diseases):

[Epilepsy]
 [Vascular]
 [Alzheimer's]
 [Progeria]
 [Late catatonia]
 [Involution melancholia]
 Presenile psychoses
 Senile dementia
 Presbyophrenia
 Senile psychoses

One of the peculiar advantages of this pragmatic sequence of consideration is that the senile demented are removed so far from the arteriosclerotic cases. (Refer to note under Group V.) Kraepelin rightly terms the presenile division of psychiatric cases the darkest field in psychiatry. I am aware how many subgroups Kraepelin has proposed among the preseniles, but for the moment am unable to define what types should be given under the heading presenile psychoses.

VIII. SCHIZOPHRENOSSES (the dementia praecox group):

Hebephrenia	Schizophasia
Catatonia	D. praecoccissima
Paranoid	D. simplex
Cyclothymoid †	Paraphrenia

* This term is adopted provisionally as against the possible term presbyopsychoses, because of Nascher's choice of the term "geriatrics" for his proposed branch of medicine, dealing with the diseases of old age.

† This genus, if it be such, is devised to include the practically very important group of cases in which the schizophrenic process is precipitated by phenomena that resemble manic depressive psychosis, or in which there is a definitely cyclothymic course in itself suggesting the true cyclothymoses.

As for Group VIII, no discussion need be given concerning hebephrenia, catatonia and paranoid. To be sure, concerning the latter Kraepelin has endeavored to distinguish two forms, *mitis* and *gravis*, but whether this is a pragmatic distinction of great importance to the future of the patient is doubtful.

As for the term cyclothymoid, I feel that this concept is of some value. First, concerning the term cyclothymoid. The name of this genus, if it be such, would be "schizophrenia cyclothymoides." The ending *oides* used in the specific adjective would be in general borrowed, as in this instance, from some other genus or group. By "schizophrenia cyclothymoides" we would then mean a dementia praecox that somehow very closely resembled a manic-depressive psychosis, that is, a schizophrenia that somehow closely resembled a cyclothymia. If now there were a true cyclothymia (that is, manic depressive) that closely resembled a schizophrenia, we should be forced to dub it "cyclothymia schizophrenoides," borrowing for our specific adjective from another genus and adding the ending *oides*. This procedure would be roughly in accordance with botanical procedure. It would be purely a question of fact whether there is such a condition as "cyclothymia schizophrenoides."

As for the existence of cyclothymoid types of schizophrenia, there can hardly be any doubt that these forms exist. When Kraepelin expanded his original three forms of dementia praecox to nine, he found himself with three new subforms that I have here lumped together under the heading "schizophrenia cyclothymoides." There can be no practical doubt of their existence.

As for the other subheads under the schizophrenias, schizophasia is a small group of Kraepelin's own, of which we now and then see examples. I have added dementia praecocissima group of de Sanctis not because its existence is necessarily well established, but because there seemed to be cases which might well belong in the group if they could be held under observation for some decades longer and their course made out.

It is a question whether dementia simplex should form a genus alongside hebephrenia and whether dementia simplex is more than a mild form of hebephrenia. The term is useful for those cases of slight deterioration which we see in subjects that remain sufficiently well to be self-supporting and only slightly eccentric or dull.

The genus paraphrenia is as Kraepelin has proposed, practically Magnan's disease, that is the *délire chronique à évolution systématisée*. Kraepelin gives four subclasses of this disease which may possibly be species or varieties, namely, paraphrenia systematica, confabulans, phantastica, expansiva.

IX. CYCLOTHYMOSSES (the manic-depressive and cyclothymic group of mental diseases) :

Cyclothymic constitution	Mania
Manic-depressive	Mixed
Melaneholia	Involution-melancholia

As to the distinction between manic-depressive and the mixed forms of cyclothymia, I would suppose it wise to call manic-depressive cases (in this generic sense) those in which both mania and depression in different phases of the patient's course are developed.

It would be wise in my opinion to replace the term manic-depressive as a group designation with the term cyclothymia, which brings out the affective features and the phasic features of the disease. If a case is cyclothymic, we shall be able to arrive at the diagnosis having excluded all its competitors for preference down through the schizophrenias.

Now let us say that we are confronted by a case of pure mania or pure depression which we know is not syphilitic, or alcoholic, or symptomatic of some somatic condition, or schizophrenic. We shall be entitled to term it cyclothymic with a high degree of probability, unless perchance on further investigation we determine it to be a psychoneurotic phenomenon. But, again, can we say that this phase of mania or depression is going to be followed by its opposite, depression or mania? It seems to me that we decidedly cannot. The prognosis would better be confined to saying that emotional disorder is likely again to occur. Is not this approximately the extent to which one can now go in making a prognosis in cyclothymic cases? The future may do more for us than has the past. Wernicke remarks that no case of chronic mania was ever initiated by an acute mania. A number of important and easily manageable statistical researches could be made on this line; but psychiatrists are not particularly interested in such statistical researches, however valuable in prognosis, their results might be, because they seem to be under the spell of the idea "manic-depressive." According to my conception, the idea of manic-depressive is the idea of a large group of diseases. It is questionable whether Kraepelin discovered a new disease. He defined a great group of diseases, each of which had already been defined, as having certain affinities with one another.

As for the term mixed, I wish by this term to signify cases in which depressive and maniacal phenomena are commingled within a single phase of the disease.

As for involution-melancholia and its placing among the cyclothymias, I do not wish to take a definite stand. Very possibly this disease would better be placed amongst the old age phenomena, as the term involution would suggest.

X. PSYCHONEUROSES :

Hysteria
 Neurasthenia
 Psychasthenia

This is not the place to discuss the genera and species and varieties of the psychoneuroses. Walton some years since insisted on the value of not making generic diagnoses of neurasthenia, psychasthenia or hysteria. He would have the diagnostician confine himself to terming the case psychoneurosis.

Regarding hysteria, I am inclined to think that in many early phases of these psychoneuroses, Walton's plan is beneficial. It is a question how far a diagnostician wishes to go. Some physicians are perfectly content to call a case mental, that is to say, under the *morbi mentales*, and let it go at that. Others will be content to place a case, for example, under the psychoneuroses and then call in some person especially qualified to cure the case; for the psychoneuroses form essentially the psychotherapeutic group. The specialist may wish to go farther and identify the genus or species, or even the varieties of the large group. No doubt the progress of science depends on further developments in these directions, provided that these developments be pragmatic ones in the interest of helping the patient.

XI. PSYCHOPATHOSES (the psychopathic group of mental diseases) :

Prison psychoses	Sense deprivation psychosis
Folie à Deux	Monomania
Litigation psychosis	Psychopathia sexualis
Paranoia	Psychopathic personality

Concerning the last or eleventh group, there might be much to say. Let me say here that I would speak of this group in common parlance as the psychopathias, not using the ordinal term psychopathoses except in contradistinction to other ordinal groups. The existence of these scientific terms having relatively exact distinction should not preclude our every-day use in the clinic of commoner terms. Just as one would not order *Rosaceae* at the florist's or *Leguminosae* at the grocer's, so one would not use these scientific terms except when one was in doubt exactly where a case ought to belong. In the progress of psychiatric science, the genera under this eleventh group ought to become more and more definite. Some of the genera will doubtless be relegated to pre-existent groups; others may form new orders suitable to elevation to the rank of groups like the psychoneuroses, the syphilopsychoses, etc. I have given in the preceding a small collection of these doubtful psychopathias. None of these require special mention here, perhaps.

Paranoia, I place among the doubtful psychopathias because I do not see that it has been proved to have a schizophrenic nature, and feel that it cannot otherwise be placed in the previous groups. The suggestion that it is a sort of intellectual infantilism is an attractive one, but it seems a little far fetched to place our apparently complex paranoias amongst the feeble-minded.

Some persons might object to the use of the term monomania, but if we do not use this term we should need to enumerate such genera as kleptomania, pyromania and poriomania (*Wanderlust*). The polemic in which the term monomania was overthrown is long since reduced to ashes. The term it seems to me remains a good one for precisely those nonsexual cases with unusual development of particular instincts.

As for the term psychopathic personality, it is surely a bone of contention; but if we exclude the sexual cases under the term psychopathia sexualis and exclude the cases with special instincts in strong relief (the monomanias), we shall then have on our hands certain cases of psychopathic personality that are apparently worthy of a place. Many of the so-called defective delinquents very probably fall in this group, though an endeavor should constantly be made to place them amongst the hypophrenics, the epileptics, the schizophrenics, the psychopathic monomanias, etc. All psychiatrists agree that we should not prejudice the situation in criminology by terming all defective delinquents forthwith psychopathic personalities. Let us leave room for the existence of criminals that are not psychopathic.

One might inquire whether there are not certain psychogenic cases that might belong in this eleventh group, that is, cases which cannot be regarded as hysteric, neurasthenic or psychasthenic. Doubtless the neuropsychiatry of the war will help to resolve that question.

SUMMARY

In this paper I have tried to amplify the key to the practical grouping of mental diseases presented to the American Neurological Association in 1917. I have amplified it by proposing certain genera comprised under each of the eleven major groups of mental diseases. These genera have been placed in the sequence supposed to be the pragmatic sequence in which the inexpert diagnostician should seek to exclude successively the various genera; in short, just as the key to the practical grouping of mental diseases dealt in a certain sequence with eleven major groups, so here the diagnostician is given an idea as to the proper method of considering one after another the genera comprised in each great group. No endeavor has been made to revamp or especially modify the ideas of psychiatrists as to what psychotic entities exist. Finality cannot be hoped for either theoreti-

cally or practically. The principle of diagnosis *per exclusionem in ordine* is the special principle insisted on. *It is applicable to any diagnostic problem after the data of observation are collected.* True diagnosis can only take place after sufficient data are collected, and efforts to make diagnoses early in the stage of collecting data are apt to result in prejudice.

The writer earnestly hopes for critique of his propositions. Such critique he hopes will be separated into:

- (a) Critique of the general principle of *diagnosis per exclusionem in ordine*.
- (b) Critique of the genera chosen for the different groups.
- (c) Critique of nomenclature.

But judging from the world's experience in the past, it is unlikely that many persons will be able to distinguish nomenclature from the objects named and the method of using a classification from the classification itself. Herein some nomenclatural suggestions are made; but they have nothing to do with the main line of argument. Herein a certain classification is adopted, but there is absolutely no pretence to originality therein. The writer's main emphasis is on the pragmatic principle of diagnosis, namely, the principle of diagnosis by exclusion in order which principle will prove useful or useless without regard to the classification which it endeavors to exploit or the nomenclature which it uses by the way.

Editorial Announcement

About 100 leading neurologists and psychiatrists formally requested the Board of Trustees of the American Medical Association to undertake the publication of a new journal devoted to nervous and mental diseases. After due consideration the trustees granted the request, and this first number of the ARCHIVES OF NEUROLOGY AND PSYCHIATRY is the result.

We must all recognize that during the last twenty-five years there have been great, at times startling, advances in neurology and psychiatry. It is not so well recognized that in the recent war the neurologist and psychiatrist at the front has probably been of more importance than the internist. And we believe that it will be generally admitted that the mass of the medical profession is not so well informed on nervous diseases and mental disorders as on most other branches of medical science.

The trustees agreed with the petitioners that there was need of a publication which would at once stimulate the efforts of the best neurologists and psychiatrists of the country and serve as adequate medium for reports of the fruit of their labors; which would keep its readers in touch with the best work in all countries, and which would help to elevate the general standard of knowledge of the nervous system and its diseases. Just at this time the need is greater than ever before. The war has been a great school, but many of the lessons taught need to be—must be—more generally known. The complexities of civil life are increasing, changes are rapid and more are impending. The enormous industrial development in the United States has involved and will involve injuries and disease of the nervous system, psychoneuroses and psychoses. All of these things demand research, report, education. In short, the need is for a scientific publication of high ideals which shall not only serve the purpose of the research man and technical expert, but which shall also be of immediate practical value to the clinician. This need the ARCHIVES OF NEUROLOGY AND PSYCHIATRY aspires to meet.

Owing to many difficulties and delays the editorial organization is not complete, and the board is keenly alive to the defects of this first number. The unexcelled facilities of the American Medical Association press will leave nothing to be desired in the way of illustrations: colored and black and white. It may be proper to add that the *ARCHIVES* is published for the benefit of the medical profession and in the interest of scientific medicine and not for monetary gain. It will be as ethical, as independent and as helpful as the editors can make it. In return they hope for the sympathy and support of their colleagues.

THE EDITORIAL BOARD.



MAJOR ALFRED REGINALD ALLEN, U.S.A.

1876—1918

Obituary

MAJOR ALFRED REGINALD ALLEN, U.S.A.
1876-1918

CHARLES K. MILLS, M.D., LL.D.

Major Alfred Reginald Allen was born at East Greenwich, R. I., May 26, 1876, and died in France, September 30, 1918.

He came to his untimely but glorious end toward the close of the great war at the height of the fierce and prolonged engagement known variously as the Battle of the Meuse or of the Argonne. The battle was largely fought over the ground intervening between the Forest of the Argonne and the west side of the Meuse. On September 26, a commanding position known as Montfaucon was captured by the American forces. The fight continued until October 4. About 5:30 in the afternoon of September 29, Major Allen, while directing his battalion at the little village of Nantillois, a few miles from Montfaucon, received a fatal shrapnel wound in the head. He did not regain consciousness, and died at 4 o'clock on the morning of September 30. He was buried with military honors not far from the place of his death.

Major Allen was the lineal descendant of Samuel Allen, a Friend from Chew Magna, near Bristol, England, who arrived with his wife and family where Chester, Pa., now stands, on Dec. 11, 1681. Samuel Allen had a long line of descendants, some of them well known in the annals of Pennsylvania.

Through the marriage of Nicholas Waln's daughter, Jane, with Samuel Allen, Jr., son of the progenitor of the family in this country, Major Allen was also a descendant in the direct line from Waln who came in the ship "Welcome" with William Penn in 1682. Dr. Harrison Allen, the distinguished Philadelphia anatomist and surgeon, was a first cousin of Major Allen's father, the Rev. George Pomeroy Allen, D.D.

The American founder of the Pomeroy family, from whom Major Allen was descended through his paternal grandmother, was one Eltweed Pomeroy, born at Beaminster, County Dorset, England, in 1585. He landed in America with his family in 1630 at Matapan on Massachusetts Bay, where he and his companions laid out the town of Dorchester. This Eltweed Pomeroy, genealogical records show,

Read at the meeting of the Philadelphia Neurological Society, Dec. 18, 1918.

had a highly distinguished ancestry, and some of his descendants were noted in American history. One of them, Gen. Seth Pomeroy, was an officer in the French and Indian War, fought in the ranks at the Battle of Bunker Hill, and later became a major-general in the Patriot Army.

The mother of Major Allen was Elizabeth, daughter of Mark Anthony DeWolf Howe, the first bishop of the central diocese of Pennsylvania. Mark Anthony DeWolf, the common ancestor of all the DeWolfs of Rhode Island, was born 1726 and died 1793. He was the great-great-grandson of Balthasar DeWolf, apparently the first of his line in this country, mentioned in the records of Hartford, Conn., in 1656. The DeWolfs were prominent in Rhode Island, one of them, James DeWolf, being a United States senator about 1820. The Howes were descended from James Howe, who came from England in 1637 to Roxbury, Mass.

It is rare that one can point to so long and honorable an American lineage as that of Major Allen, whose progenitors in all lines settled in this country more than two centuries ago.

Allen's preparatory education was at Selwin Hall, near Reading, Pa. He was a student at Lehigh University in 1893 and 1894, and graduated in medicine at the University of Pennsylvania in 1898. He married on Jan. 21, 1904, Helen, daughter of E. Burgess and Emma (Bolton) Warren. His wife survives him and he leaves two children, Alfred Reginald Allen, Jr., and Helen Warren Allen, twins, born March 22, 1905.

For several years after his graduation, Allen was associated as personal and hospital assistant with the late Dr. S. Weir Mitchell. He was held in high esteem by Dr. Mitchell, from whom he received his first impulse to the pursuit of neurology.

In 1905, Allen engaged in pathologic research in the laboratory of neuropathology of the University of Pennsylvania. In the following year he became formally connected with the neurological staff of the University Medical School. From 1907-1911 he was instructor in neurology and neuropathology; from 1907, assistant neurologist to the University Hospital; from 1908 until the time of his death, one of the chiefs of clinic of the neurological department, and from 1911, associate in neurology and neuropathology. For several years he was assistant neurologist to the Philadelphia General Hospital.

Allen was a fellow of the College of Physicians of Philadelphia; and was a member of the Philadelphia Neurological Society, of which he was secretary in 1908 and 1909, and president in 1910. He was a member of the American Neurological Association, of which he was secretary and treasurer, 1909-1917. He was one of the original

members of the American Psychopathological Association, of which he was president, 1914 and 1915. As secretary of the United States delegation, he attended the Sixteenth International Medical Congress at Budapest in 1909, and in the same capacity the Seventeenth International Medical Congress at London in 1913.

In the Philadelphia Postgraduate School of Neurology, Allen gave several courses of instruction on neurophysiology at his rooms in the medical laboratories of the University of Pennsylvania. This instruction, which was both didactic and demonstrative, was highly appreciated by the students in attendance.

The neurologic contributions of Allen were chiefly published within a period of ten years, from 1905 to 1914. While not numerous, they were valuable, and illustrated his ability as a clinician, his technical proficiency with the microscope, and the initiative of a mind always alert and progressive.

His first noteworthy neurologic paper, on "Combined Pseudo-systemic Disease, with Special Reference to Annular Degeneration," was published in the *University of Pennsylvania Medical Bulletin*, January, 1905. This and nearly all his other writings are to be found in the series of "Contributions from the Department of Neurology and Laboratory of Neuropathology of the University of Pennsylvania," these volumes being made up largely of reprints of articles published by members of the department in medical journals. In this paper he first discusses the centripetal and centrifugal blood supply of the spinal cord, and then presents in careful detail a clinical history, and the results of his examinations and histologic investigation. His conclusions favor the theory of the vascular origin of such well known spinal affections as the various forms of poliomyelitis, Friedreich's ataxia, disseminated sclerosis, paralysis agitans and tabes dorsalis.

A second article entitled "The Connective Tissue Character of the Septa of the Spinal Cord as Studied by a New Stain," appeared in the *Journal of Nervous and Mental Disease*, December, 1906. This paper is brief and is chiefly valuable as showing the tendency of the author to reach out into new fields. By means of the stain, the use of which is clearly described, Allen was able to demonstrate the fact that the posterior median septum of the spinal cord, as well as a number of the septa of the lateral columns, contain connective tissue which is continuous with the pia.

A third paper written in collaboration with Dr. William G. Spiller was published both in the *University of Pennsylvania Medical Bulletin*, March-April, 1907, and in *The Journal of the American Medical Association*, April 13, 1907. The subject was "Internal Hydrocephalus, with the Report of Two Cases, One Resulting from Occlusion of the

Aqueduct of Sylvius." In this contribution, after an excellent summary of the literature of the subject, microscopic and macroscopic reports of two interesting cases are given.

In 1907, the "Contributions of the Department of Neurology and Laboratory of Neuropathology" contained an article prepared in collaboration with the writer on "Two Cases of the Polyneuritic Psychosis with Necropsies and Microscopical Findings." This paper was read at the sixty-third annual meeting of the American Medico-Psychological Association, Washington, D. C., May 7-10, 1907. It was, in the main, a study of the probable etiology and pathology of Korsakoff's disease, and it contained brief references to other contributions.

A careful anatomic study was incorporated in a paper by Allen on the "Distribution of the Motor Root in the Anterior Horn," *University of Pennsylvania Medical Bulletin*, November, 1907.

Elsewhere I shall speak of Allen's ability as a musician and student of harmony. In one of his papers he applies this gift in describing "A New Diagnostic Sign in Recurrent Laryngeal Paralysis," *Journal of Nervous and Mental Disease*, 1908. The development of the sign was dependent on an observation of Allen that when the laryngeal paralysis was unilateral there was a very material difference in the upward excursion of pitch, if the vocal apparatus was stimulated electrically during the singing of a tone. The sign, as the author indicates, is of curious interest rather than of wide practical application.

One of Allen's most elaborate papers was that on "Injuries of the Spinal Cord," *University of Pennsylvania Medical Bulletin*, April, 1908. It covered between thirty and forty pages, and was profusely illustrated with photographs of gross specimens and photomicrographs. These illustrations, which represent some of the best work of the kind in the literature of neurology, indicate by their remarkable quality Allen's skill in photography.

The following is a list of other papers published by Allen between 1908 and 1914:

"The Symptom-Complex of Transverse Lesions of the Spinal Cord and Its Relation to Structural Changes Therein," *American Journal of the Medical Sciences*, May, 1908.

"Delayed Apoplexy (*Spätaoplexie*), with the Report of a Case," "Contributions from the Department of Neurology and Laboratory of Neuropathology, University of Pennsylvania," 1908.

"Hemorrhage into the Ventricles, Its Relations to Convulsions and Rigidity in Apoplectiform Hemiplegia," *The Journal of the American Medical Association*, July 18, 1908.

"Special Features Concerning Multiple Neuritis," *University of Pennsylvania Medical Bulletin*, November, 1909.

"Concussion of the Brain," *The Journal of the American Medical Association*, September 10, 1910.

"The Histopathology of the Preparalytic Stage of Acute Anterior Poliomyelitis," *Pennsylvania Medical Journal*, December, 1911.

"Surgery of Experimental Lesions of Spinal Cord Equivalent to Crush Injury of Fracture Dislocation of Spinal Column (Preliminary Report)," *The Journal of the American Medical Association*, September 9, 1911.

"The Effect of the Removal of the Hypophysis in the Dog," written in collaboration with Dr. Joshua Edwin Sweet, *Annals of Surgery*, April, 1913.

"Remarks on the Histopathological Changes in the Spinal Cord Due to Impact," *Journal of Nervous and Mental Disease*, March, 1914.

These articles all contain material worthy of record, and some of them are especially notable, as for instance, those on delayed apoplexy, hemorrhage into the ventricles, on the surgery of experimental lesions of the spinal cord, on the histopathologic changes in the spinal cord due to impact, and the effect of the removal of the hypophysis.

As the result of the investigations incorporated in his papers on spinal crush injuries and on the histopathologic changes in the spinal cord due to impact, Allen suggested an early operative procedure in severe spinal traumatism, which was afterward put into successful practical application by Dr. C. H. Frazier. This consisted in a median longitudinal incision directly through the injured area of the cord. The physiology of the beneficial action of this incision was ascribed by Allen "to a draining of the cord at this point of blood and serum, and thereby not only preventing the pressure of this exudate on the nerve elements, but also removing what would in time, through chemical change, give rise to a biochemical irritation with destruction of tissue."

During Allen's stay in England in 1913, he did some laboratory work on the cerebellum. He again took up cerebellar research after his return to this country, but this work was interrupted by the war.

Besides the contributions of Allen thus hastily summarized, he delivered able presidential addresses on some phases of psychoanalysis before the American Psychopathological Association and the Philadelphia Neurological Society.

Allen collaborated with Dr. Charles H. Frazier in the production of his work on "The Surgery of the Spine and Spinal Cord," published in 1918. For this book he wrote an excellent chapter on the "Normal and Pathological Physiology of the Spinal Cord," and in other ways was associated with Dr. Frazier in the preparation of the volume.

Allen was a lover of music and a close student of harmony. When very young he composed an opera, both words and music. He was the author of many songs, some church music and an overture.

He organized the Savoy Opera Company for the amateur production of Gilbert and Sullivan's operas. This company gave as its first performance "Trial by Jury," in May, 1901, and is still successfully

producing a Gilbert and Sullivan opera each year. During his active connection with the company Allen trained all the cast and chorus, and conducted the orchestra.

He wrote the music for a Christmas carol, the words for which were furnished by the Rev. Louis F. Benson. He also wrote the music for one of the hymns of the war hymn-book entitled "For God and Country."

Allen was the musical editor of the revised edition of "The Hymnal," of which Dr. Benson was the editor-in-chief. "The Hymnal" was published by authority of the General Assembly of the Presbyterian Church in the United States, 1911. Allen's duties as musical editor were to revise the harmonies of the tunes, a work for which he was peculiarly well fitted. He wrote for the hymnal several new hymn tunes and several chants.

Although Allen never took a lesson on the piano, his knowledge of the theory of music and his natural musical gifts were such that he could play with ease, fluency and grace. He was also an excellent violinist.

Among Allen's many gifts was that for languages. He was an earnest student of the origin of languages and had much facility in acquiring a language, for the purposes of speaking and reading it. It was said of him by one who knew him well that "he thought no more of studying a new language than a lawyer of undertaking a new case." This facility was assisted by his powers of concentration on any subject which he had in hand. He was an industrious collector of books on languages. During his travels abroad in Belgium, Holland, France, Germany and Italy, he was in the habit of getting the school-books of the places visited, studying by their aid the history, features and customs of the countries through which he was traveling.

As illustrating his powers of concentration, one of his intimate friends writes:

"This was shown by his enthusiastic work in higher mathematics which he developed under the stress of coming into contact with the problems of modern gunnery, thus promoting an efficiency in that department, which enabled him to become the commandant of the Infantry School of Arms, a position which he held for a short time."

"Perhaps the quality in Major Allen's mental constitution that most impressed a fellow student," says the same friend, "was the great width and variety of his accomplishments, each one of them pursued with so much intensity and yet at the same time made to cohere and co-operate by the perfect sanity of his mind and the catholicity of his interests. He was at once absorbed in the particular work that employed him, but with a mind so disciplined that not only every pursuit but every fact was kept in its own pigeon-hole, and he himself was able to pass from one to another with the least possible mental friction."

Allen was a skilful photographer and a good pen-and-ink draftsman. At one period he acted as photomicrographer at the medical laboratories of the University of Pennsylvania, producing work of much technical excellence for publications issued by some of the departments. His own papers were sometimes illustrated by original photographs and drawings of unusual merit.

Besides his medical photography, Allen did fine work in general photography. When the writer of this article was engaged in a local historical research, covering a district of Philadelphia, Allen sometimes accompanied him on his trips, taking beautiful landscape and other photographs.

From the time when, in 1914, Belgium was invaded, Allen had a strong feeling that it was his duty to serve the cause of liberty against German aggression.

When the training camp was organized at Plattsburg, N. Y., he was one of the first to go there. He went in August and September, 1915, and again in August and September of the following year. During his stay at Plattsburg he was commissioned first lieutenant in the reserve corps, and in October, 1916, was commissioned major. After war was declared he was ordered to the training camp at Fort Niagara, where he spent the summer of 1917. In the fall of 1917, he was transferred to Camp Meade, Md., where he remained a short time and then was sent to the training school at Fort Sill, Okla. He returned to Camp Meade where he became director and, for a short time, commandant of the School of Automatic Arms in the Infantry School of Arms of the Seventy-Ninth Division. He was made major of the 314th United States Infantry and arrived in France with his regiment in July, 1918, which was in a brigade commanded by Brigadier-General Nicholson, being a part of the Seventy-Ninth Division under the command of Major-General Joseph E. Kuhn. The division was a part of the Fifth Army Corps of the First American Army. All his military duties were faithfully and efficiently rendered, and he was beloved alike by the officers and men of his battalion. The time and manner of his death have been mentioned at the beginning of this sketch. I saw him last in January, 1918, when he was on a visit to Philadelphia from Camp Meade. He talked seriously of the great task which confronted the allies, but was full of ardor and enthusiasm and related to others and myself of the company where we met, many interesting details of his recent military experiences.

The high esteem in which Major Allen was held by those familiar with his military career is shown in two letters to his wife regarding him — one by a fellow officer, Capt. Frederick A. Muhlenberg, U.S.A., and the other by Fullerton L. Waldo, the well known journalist.

Captain Muhlenberg writes as follows:

What a sense of loss we all feel. The Major was always sympathetic and kind to the officers in the regiment and helped them at all times by any powers at his command. I have always believed that his nerve in choosing the infantry, with his special knowledge and willingness to share it made a real case of "the greatest good for the greatest number." His thoughtfulness for others and quick thinking under harassing conditions have set us a true example of the perfect soldier.

I feel a very deep sense of personal loss. I was under the Major at Niagara, where he was very kind to me. At Camp Meade I was his adjutant in the early days and quickly came to recognize his great ability and charm. Over here I have often been honored by his confidence and I really feel that I have lost a close and dear friend.

While I was evacuated too soon to learn the details of either his death or burial (I got a bullet-scraps on the side of the head and various burns from mustard-gas) I am sure, from the universal expressions of regret which I heard on the way back (from the regimental commander to some of the "buck privates" in the rear rank of the battalion) that all the honors which could be paid him were paid. Major Allen had the universal love and respect of all who knew him. Your children have been given a great heritage.

Mr. Waldo writes:

I may not lay claim to the deeper intimacies of Major Allen's friendship, but wherever and whenever his life touched mine I felt the inspiration. The first time was when he wrote out for me offhand a musical score from memory. Again, at drill under the trees at Rosemont his explanations of maneuvers were brilliant and disclosed his real and rare ability as a leader of men.

At Plattsburg he was a joy to all who heard him talk, and his ministrations to men footsore by the long and heavy marches won the gratitude of a host. I was always comfortable under the most trying conditions because I strictly followed his injunctions.

When last spring I spoke at Camp Meade, there he was, sitting in the front row to encourage me. He of all men, who knew a thousand times more of warfare than I could ever hope to tell him from the brief page of my experience abroad!

An extraordinary versatility that ran no risk of being superficial; a shrewd insight that never hurt the feelings of others; a quick sense of humor; a passion for scholarly analysis without pedantry; the graceful *savoir-faire* of a man of the world united to every finer sensibility of feeling—these were some of the characteristics that marked Major Allen and that now must bring you, in the midst of loss irretrievable, a legacy of precious memories of the noble man of nature that he was. Words have no wings in such an hour, and yet it is something to you to feel that besides God's infinite mercy you have the commiseration of those who stand with you uplifted, in the black hour of grief, by the exemplary life and death of a soldier and a gentleman—martyr and hero for the sake of us all.

Major Allen is no longer with us. Regard for his memory is united with deep sympathy for his family, but one may not intrude too far with words of condolence, always so difficult, on the intimacy of the grief of those who mourn for their beloved. Speaking for his medical

associates and especially for his neurologic colleagues, I can testify to the high esteem and affection in which he was held. His brethren of the American Neurological Association will miss his inspiring presence. The secretarial work of the association was never done so well and thoroughly as during the period of his official connection. At the annual dinners of the association he was the enlivening spirit, charming those present with his rhythmic and musical improvisations.

While Major Allen was not a society man in the accepted use of the designation, he had social gifts which made him a delightful companion in the drawing room and at the festive board. He enjoyed conversation. Music; poetry and the quick interchange of thought had for him a strong appeal. He was a fluent and eloquent talker; quick at repartee, and earnest in argument. His wit was incisive; his irony gentle; his humor genial. He yielded his life in a cause which appealed to his inmost nature. Gone from our midst, in spirit he is still with us.

"Fame is the spur that the clear spirit doth raise
(That last infirmity of noble minds abhorred)
To scorn delights and live laborious days;
But the fair guerdon when we hope to find,
And think to burst out into sudden blaze,
Comes the blind Fury with the abhorred shears,
And slits the thin-spun life. 'But not the praise,'
Phœbus replied, and touched my trembling ears:
'Fame is no plant that grows on mortal soil,
Nor in the glistening foil
Set off to the world, nor in broad rumour lies,
But lives and spreads aloft by those pure eyes
And perfect witness of all-judging Jove;
As he pronounces lastly on each deed,
Of so much fame in heaven expect thy meed.'"

Abstracts from Current Literature

THE NATURE OF NERVOUSNESS IN SOLDIERS. FOSTER KENNEDY, J. A. M. A. 71:17, July 7, 1918.

The essential of this paper is a discussion of the dynamic factors which cause war neuroses, which Kennedy prefers to call nervousness, and for which he considers the term "shell shock" to be particularly inappropriate. He starts from the fact that these neuroses do not develop in men who have sustained physical injuries. He thinks that the dynamic force in the production of the nervousness is the antagonism between the conscious emotion of loyalty, with its concomitant urge for self-sacrifice, and the more or less well-repressed instinct for self-preservation with its shrinking and fear of death. Careful inquiry revealed the fact that being wounded is apt to be followed by a period of mental rest, because the patient is quit of his obligation to others and freed from his fear of death; in other words, both his social instinct and his instinct for self-preservation are satisfied; on the other hand, a man who suffers from stupefaction consequent to heavy shell burst without being wounded still has the obligation to persevere. In such a case the instinct for self-preservation becomes the stronger and the patient becomes fearful, etc.

He takes up the fact that some medical officers claim the coexistence of psychoneurosis and somatic injuries, but affirms that they are speaking of patients who have been transferred to England, while if the patients are seen early, the combination is rare, and when it occurs later it is probably due to psychogenic causes and unwise treatment.

He also mentions localized injuries and speaks of the fact that, in his experience, almost all injuries to extremities are accompanied, for a short period at least, by palsy of the limb, quite apart from any organic nerve injury, and urges that the capacity to make a careful neurologic examination and to feel perfectly certain regarding the differential diagnosis between a functional and organic condition is absolutely essential for the proper treatment, because any doubt expressed by the physician sows the seed for a fixed idea.

He finally speaks of the fact that we are indebted to Freud for the realization that neurotic symptoms may be produced by the antagonism of mutually incompatible emotional trends, and that these psychoneuroses in soldiers furnish a good evidence of this; that they are, however, also an excellent illustration of the fact that the freudians have gone much too far with their pan-sexualism. The latter is probably true, but it seems hardly fair to adduce these war neuroses as an argument against the freudians in this respect, because probably even a dyed-in-the-wool freudian would frankly accept the totally different etiology of these cases from those of the peace neuroses and agree that in these war neuroses a different instinct is at work and one which is but little threatened in ordinary life nowadays.

He ends by saying that he has only dealt with the psychologic aspect of the problem without being unmindful of the physical changes which accompany violent emotional disturbances and which result in alterations of the physiologic balance of the involuntary nervous system, in regard to which we are not sure whether they are primary or secondary.

Hoch, Santa Barbara, Calif.

STIMULATION OF THE MOTOR CORTEX IN A MONKEY SUBJECT TO EPILEPTIFORM SEIZURES. C. S. SHERRINGTON, M.D., F.R.S.,
Brain, 41: Part 1, p. 48, June, 1918.

The author, stimulated by means of a unipolar faradic current the motor cortex of a "Jew" monkey (*Macacus fuliginosus*) subject to epileptiform seizures which probably began in the tongue, but which appeared to begin in the left angle of the mouth and spread to the facial muscles, neck, arm and leg of the left side and then to the right side. Attacks were induced by taking into the mouth large morsels of food.

Abnormal reactions were obtained nowhere except in the "tongue" areas of both hemispheres, especially in the right where the briefest stimulation produced maximum contractions of the tongue which by no persistence of faradization could be made to extend beyond the face. No gross lesions or abnormalities were visible in the cortex.

These experiments are unusual in that (1) it is, according to the author, the first recorded instance of faradization of the cortex of an animal suffering from idiopathic epilepsy, and (2) in that the nature of the responses to stimulation of the "tongue" area were not only unusual, but were more readily evoked in an area of the brain which usually fails to easily produce epilepsy on stimulation.

WEISENBURG, Philadelphia.

PREDISPOSING FACTORS OF WAR PSYCHONEUROSES. JULIAN
WOLFSON, J. A. M. A. 70:303, Feb. 2, 1918.

Pearce Bailey writes a short introduction to this paper from which we may quote the fact that nowadays 85 per cent. of the English soldiers are no longer returned to English special hospitals, but are treated near the line, since it has been found to be better not to release them from military discipline; also that the chief method of treatment is now strong persuasion, with electricity given for its psychic effect.

Wolfsohn's study was made at the instigation of Mott. He studied 100 cases of war neuroses and 100 cases with somatic injuries which he used as controls. In these two groups he compared the family history, the patient's make-up, the personal history and some other factors.

He showed that nervousness, irritability of temper, insanity and epilepsy were much more common in the family history of the neurotics than in that of the controls. Rather striking is the fact that insanity and epilepsy occurred in the neurotics in 34 and 30 per cent., respectively, while it did not occur in the controls at all. As regards the personal history, it was found that previous nervousness was present in 66 per cent. of the neurotics (12 per cent. of the controls); fears in 50 per cent. of the neurotics (8 per cent. of the controls); moodiness in 55 per cent. of the neurotics (8 per cent. of the controls).

Of some interest are the experiences with alcohol. In the family history, alcoholism occurred in 50 per cent. of the neurotics (24 per cent. of controls); but in the personal history it occurred in only 6 per cent. of the neurotics (16 per cent. of the controls). There were 30 per cent. teetotalers in the family history of the neurotics (only 16 per cent. in the controls), and 48 per cent. teetotalers among the neurotics themselves (20 per cent. among the controls).

Wolfsohn mentions the fact, also pointed out by Kennedy, that none of his cases of war neurosis had a somatic wound, the usual history being that a shell burst near the patient, who was knocked over or buried or just dazed, after which the neurosis followed. The symptoms had, however, developed gradually before this final precipitating cause, inasmuch as such patients were

for weeks easily fatigued, "nervy," had frightful dreams, complained of loss of self-confidence and the like.

A few other comparisons are of interest: He states that the control cases do not look nervous, do not have cold, clammy hands, or insomnia or depression of spirits—all of which are frequent in the neurotics. A prolonged dazed period followed the explosion in 84 per cent. of the neurotics and in only 24 per cent. of the controls. Poor memory and concentration were present in 88 per cent. of the neurotics and in only 4 per cent. of the controls. In the wards with neurotics an air raid or even a thunder storm brings about trembling, nervousness and headaches in the patients, which are quite absent in a surgical ward.

Hoch, Santa Barbara, Calif.

A NOTE ON THE OCULO-CARDIAC REFLEX. R. M. STEWART, Rev. Neurol. and Psych., 16:67, March-April, 1918.

The author cites a case of bullet wound of the right side of the neck accompanied by signs of involvement of the right cervical sympathetic in that there was exophthalmos, myosis, anidrosis and some ptosis on that side. From this accidental situation, he endeavors to draw conclusions based on experimentation, of the centrifugal path and controlling mechanism of the oculo-cardiac reflex. Pressure on the eyeball of the left unaffected side was succeeded by a slowing of the pulse rate from 76 to 52 per minute; on the right side there was little if any slowing, but no acceleration. This would be according to rule providing it could be shown that the vagus of the right side were either badly injured or divided. But from collateral observations, namely, that there was no palatal paralysis and that the intrinsic muscles of the larynx on the right side were unaffected, he concludes that the vagus was not injured and hence the oculo-motor reflex absence on the right must have been due to destruction of sympathetic fibers. That is to say, the oculo-motor reflex depends on both the vagus and sympathetic being intact, and not only on the vagus.

But his deductions do not seem warranted, as the number of unknown factors in the accidental picture were too many. His assumptions of alternative routes of travel of the impulse from eyeball via sympathetic and vagus alone make any definite conclusion impossible. Yet the article makes interesting reading for the speculative neurologist.

TIMME, New York.

THE WAR NEUROSES. W. B. TERHUNE, J. A. M. A. 70: 1369, March 11, 1918.

Only a few points in this article need be mentioned. Terhune claims that 25 per cent. of the cases he examined had had "shell shock" previously, says that the claim shell shock does not occur among the wounded is a mistake, and that he has often seen mild cases among the latter. He admits, however, that severe cases are comparatively rare. He gives an analysis of the frequency of certain symptoms in 100 cases, of which we will mention a few. Headache was found in 85 per cent.; tremors in 70 per cent.; insomnia in 62 per cent.; vertigo in 55 per cent.; debility in 44 per cent.; a period of unconsciousness in 41 per cent.; tachycardia in 26 per cent.; but apprehension in only 14 per cent.; memory defect in 14 per cent.; depression in 12 per cent.; mutism in 11 per cent.; confusion in 4 per cent. He also mentions the fact that the patients are very emotional, and the frequency of cyanosis of the hands. Studies of blood pressure in 200 cases showed that the blood pressure and the pulse rate in severe cases were usually higher than in milder cases, and that there was a noticeable vasomotor irritability in most instances. With improvement, the blood pressure fell. There were, however, also severe cases in which blood pressure and pulse were never above the normal.

Hoch, Santa Barbara, Calif.

EXHAUSTION PSEUDOPARESIS. J. RAMSAY HUNT, J. A. M. A. 70:11, Jan. 5, 1918.

Hunt found in a training camp for officers, among 1,500 men that were examined, eleven men who showed beginning paresis or early cerebral syphilis. In all these cases the diagnosis, which was confirmed by serologic findings, was made largely on physical symptoms, the men presenting no mental symptoms and having attracted no attention either by their behavior or their work. But there were three or four men with similar physical symptoms and even certain mental manifestations in whom, however, the serologic findings were absolutely negative, while a week's rest removed any suspicious symptoms. The cases were men over 30 who had not been used to physical exercise, had been in camp for about a month, where they underwent strenuous training and for some time before the symptoms appeared had arduous work at digging of trenches. The following conditions were usually found: a flushed face, a speech defect which was characterized by tremulousness, a certain amount of dysarthria and considerable "syllable stuttering," marked tremor of the facial muscles when the eyes were closed and the teeth shown. There was also tremor of the hands and tongue. The pupils were apt to be moderately dilated and unequal, and the reaction to light either entirely absent or very slight and sluggish, whereas accommodation was normal. In one case the handwriting is mentioned as irregular and tremulous. The tendon reflexes were usually active and equal, but in one case diminished and unequal. Mentally, in Case 1, the patient appeared dull, somewhat dazed, slow of comprehension, slow of response, and he showed difficulty in calculating and made occasional errors, all of which was in marked contrast to his education. In Case 2 it is merely stated that the patient was mentally somewhat dull. In Case 3 the patient showed mentally no defect, but was somewhat "euphoric and irritable," and in Case 4 the patient showed nothing in his mental condition except that he complained of nervousness and insomnia. All these patients showed absolutely negative serologic findings, and the suspicious symptoms disappeared after a week's rest. It may be added that the pupil examinations were made very carefully, both in daylight and with electric light; that Hunt refers to Redlich, who showed that after violent muscular effort the pupils may dilate and become rigid to light, and to Bumke's claim that in simple exhaustive states the pupils may be dilated and may be sluggish to light, while accommodation reaction is preserved. Hunt also points out that tremor is a well-known symptom in fatigue, as is also diminished concentration and diminished capacity for mental operations. He adds that he has never seen any such case in civil life.

HOSH, Santa Barbara, Calif.

THE INTERDEPENDENCE OF THE SYMPATHETIC AND CENTRAL NERVOUS SYSTEMS. DAVID ORR and R. G. ROWS, *Brain*, 41: Part I, p. 1, June, 1918.

From their experimental studies in rabbits and studies on neuropathologic material afforded by visceral cancer, Addison's disease and combined sclerosis, the authors are convinced that the type of lesion, namely, the distribution of the degeneration in the lateral and posterior columns, especially the localization in the middle part of the cord, diminution of changes from above downward, and the integrity of the gray matter, is not accidental but is dependent on the fact that this region obtains its blood supply from the pia-arachnoid vessels. They support their view that this localization is due to the mediation of the

sympathetic nervous system by the evidence of recent anatomic, physiologic and embryologic work. From D-1 to L-1 the intermedio-lateral tract of the cord completes the arc between the afferent and efferent sympathetic systems (the region of the lesion found). Evidence is gathering that the chromaffine system is derived from ectodermal structures.

The relation of the autonomic system and adrenal secretion is known. The fact that Addison's disease is due to adrenal insufficiency leads them to suggest that all the lesions in the cord of this variety are due to vasodilatation of the pial vessels through autonomic activity.

In discussing the relation of the vascular system to nerve cells they review the recent views that the neuroglia is an internal secretory gland and is associated with the emotions (Achúcarro); that abnormal emotions arise from disturbed humoral balance (Lugaro); that psychogenetic factors of the functional neurosis are attended by somatic factors (von Monakow); that the cortex is divided into sensory motor regions with psychic functions and is intimately connected with sympathetic centers. They suggest that hypo function of the sympathetic is responsible for most signs in the neuroses, but that vagal hypertonia may be responsible for anesthetics, aphonias and vomiting.

The experimental and pathologic work is interesting and suggests a line of investigation which will take neurologic study out of the realm of a nerve description, but the theoretical discussion, while it is interesting and suggestive, is not conclusive.

HOHMAN, Baltimore.

[The pial vessels are not known definitely to be dilated in autonomic activity —if by autonomic is meant the portion of the vegetative nervous system opposed to the sympathetic. In fact, the abdominal vessels in such activity are dilated markedly leading to the secondary collapse of pial vessels. Such collapse may readily cause the cord changes described.—Ed.]

DIE PSYCHOLOGISCHE RICHTUNG IN DER PSYCHIATRIE (The psychologic point of view in psychiatry). E. BLEULER. Paper read at the meeting of the Swiss naturalists in Zürich, 1917. *Schweiz. Arch. f. Neurol. u. Psychiat.* 2, II, p. 181-201, 1917.

It is always interesting to hear what a man of Bleuler's capacity has to say about general questions, even if he has said before most of what we find in this article. Space permits us to pick out only some features of this interesting paper. He shows that the study of hypnotism has been the real starting point for a deeper psychologic understanding of mental disorders, and that we owe a great deal to Janet for making the unconscious more generally understood. Bleuler defines unconscious processes as "all those processes which go on without the quality of consciousness, but which otherwise are identical with conscious processes." Later he takes up Freud. He thinks the essential of the freudian teachings is the claim that many symptoms arise from some psychic need of the patient. The latter creates a substitute for some unattainable satisfaction and he even states that most of these needs are in the sense of Freud sexual. The patient with a neurosis does this, according to Bleuler, by becoming sick in order to escape the struggle of life or in order to force the family to occupy itself with him, while in a psychosis the patient gets into what he calls a more or less delirious state in which his wishes are fulfilled in fancy. [The word delirium is unfortunately not any too well defined in psychiatry, but what Bleuler here means is evidently a state with abnormal ideas and a more or less pronounced exclusion of reality.] Bleuler also admits with Freud the great importance of unconscious processes and states that most pathogenic

mechanisms go on without awareness of the patient. However, one of the important facts to be familiar with in order to understand these unconscious processes is that the thinking in this realm is not logical, but what Bleuler himself some years ago called autistic (in contradistinction to realistic) thinking. If we compare logical thinking with autistic thinking we find that in the latter *affective needs* take the place of logic, and that instead of clear concepts we find symbols and similarities. Autistic thinking he regards as the primitive and assumes that logical thinking has gradually developed and has replaced the autistic as a result of increasing knowledge. He also endorses other claims of Freud, such as the repression of disagreeable ideas, the transference of an affect from one idea to another, the condensation of several ideas into one, the conversion of a repressed affect into a physical symptom. All these phenomena are not created by the disease *de novo*, but many are merely special forms, exaggerations, caricatures of the action of affects which have long been known to exist in the normal. Later he speaks at some length of the importance of affectivity in normal and abnormal states, which is far from being adequately appreciated. On the other hand, he expresses his inability to follow Freud in his views regarding the development of sexuality, and also in his too exclusive pan-sexualism, while he justly regards Adler's views as even more onesided.

So far as schizophrenia is concerned he reiterates his view that it is fundamentally a toxic disorder, but adds that sexual complexes determine much of the symptomatology. Later he states that many symptoms of schizophrenia which we regarded as direct expression of the disease process have become deprived of this dignity owing to our understanding of psychic forces. They prove to be the result of normal mental mechanisms working under changed conditions which in the case of schizophrenia is brought about by Bleuler's "association disorder." Indeed, he admits that the *outbreak of the acute psychosis in schizophrenia often has nothing whatever to do with the disease process*. Therefore, the "disease" must not be looked for in the hallucinations or in the dementia, but in the brain changes which have produced the association disorder. This knowledge (or as we would like to say at any rate the recognition of psychogenic factors in dementia praecox) is extremely important for therapeutics. It is also important from other points of view; for example, for the study of heredity. Obviously if external situations and not the disease process as such often produce the psychosis, many persons who are latent schizophrenics do not come under observation, and the hereditary disease is much more frequent than the obvious disorder (the phaenopsychosis as Bleuler calls it). He ridicules the childish simplicity with which many heredity studies have been carried on, and thinks that one of the reasons for the barrenness of results is precisely the fact that the difference in the frequency of the heredo-psychosis and the phaenopsychosis has not been appreciated. The difference also explains why parents and children are rarely schizophrenic in the same degree, since grave schizophrenics seldom marry; but the latent schizophrenics are, from the point of view of heredity, just as important as the grave ones. All this, of course, makes the study of heredity extremely difficult.

He then devotes considerable space to discussing the relationship of physical and mental causes and points out that usually both are combined, or that even in the same disease as, for example, in manic-depressive insanity, the cause may be now of one, now of the other type.

We should add that he speaks briefly of the war neuroses and regards them as well as the accident neuroses, in which damages are obtainable, as purposeful neuroses, that is, as disorders which accomplish an end, to be sure often unconsciously desired.

Hoch, Santa Barbara, Calif.

Society Transactions

AMERICAN NEUROLOGICAL ASSOCIATION

Annual Meeting, May 9 and 10, 1918, Atlantic City, N. J.

THEODORE H. WEISENBURG, M.D., *President*

DR. WEISENBURG delivered the presidential address

DR. WALTER F. SCHALLER, San Francisco, read a paper entitled, "A Case of Complete Division of the Spinal Cord in the Lower Dorsal Region with Conservation of Spinal Reflexes Below Level of Lesion."

An adult male rendered totally paraplegic following fracture of the tenth dorsal spine and consequent lesion of the cord. First observed one year and three months after injury. Examination disclosed exaggerated inferior tendon reflexes accompanied by pathologic pyramidal tract signs, marked defense reactions, increased tonus and patellar clonus. Total absence of voluntary motion in lower extremities. Paralysis of sphincters, decubitus ulcers over both hips. Absolute anesthesia below the eleventh and twelfth dorsal segments. Because of the motor phenomena a compression of the cord was suspected and a laminectomy done by Dr. Emmet Rixford, Feb. 3, 1917. A complete division of the cord tissue proper was found. The ends of both cord fragments were trimmed off and preserved for future examination. An effort to suture the two ends of the spinal cord was made and found impossible. Reexamination Feb. 22, 1917, nineteen days after operation, showed the same clinical signs as before operation. Details and discussion of physical findings. Significance of this case and similar cases previously reported in reference to Bastian's Law and compression syndrome.

DISCUSSION

DR. CHARLES K. MILLS, Philadelphia, said that this paper had been of great interest to him, not the least so because of the recital of Dr. Schaller's own case which is rather in antagonism to views which Dr. Mills has held and expressed before this association. He had no desire to challenge the report of the case, but believed perhaps it was an instance in which the exception proved the rule. His own experience had been that complete transverse lesions of the cord, those which he had observed being chiefly above the lumbar enlargement, had resulted in the loss of the deep reflexes and an almost entire absence of tonicity. Tonus, Dr. Mills believed to be cerebral in the human being, cerebral rather than cerebellar or spinal, although he did not hold that the spinal cord had no effect whatever on tonus, a subject into which he could not go here. In his mind the absence of the deep reflexes in complete transverse lesions of the cord was dependent on the withdrawal of cerebral tonectic impulses.

DR. H. DOUGLAS SINGER, Kankakee, said he would like to refer to an experiment made by Dr. James Collier of London, some years ago, which he did not think had ever been published in connection with a case of this kind. A man who had a flaccid palsy, with absent reflexes as the result of the traumatic separation of the cord, was submitted to faradization of the quad-

riceps, the needles being inserted in the muscle. There was return of the knee jerk and the man subsequently became spastic and continued so for several months before his death.

DR. ALFRED GORDON, Philadelphia, stated that several years ago in the *American Journal of the Medical Sciences*, he published the report of a case of tuberculoma of the spinal cord in which the lesion was found extending from the fifth cervical to the eleventh dorsal. The microscopic study of the case showed there was a great deal of preservation of spinal cord tissue, but much degeneration of the white matter. The tumor was located on both sides. The clinical history showed, from long observation, that from the beginning of the symptoms until the end there was absolute loss of reflexes. Knee jerks, ankle clonus and toe phenomenon were all absent. Dr. Schaller's case is one in the opposite direction. Both cases, he believed, showed that the spinal cord alone could not be considered in discussing the question of pathogenesis of reflexes. In Dr. Schaller's case there is no question that the higher centers were involved. In Dr. Gordon's case there was great preservation of the spinal cord tissue. Dr. Gordon believes that Grasset's view is more tenable than any other. He believes that the reflexes are dependable not only on the spinal cord, but also the medulla oblongata and the cerebrum.

DR. WALTER F. SCHALLER, in closing the discussion, said that in reply to what Dr. Singer said of Collier's work he referred to this work in his paper.

DR. J. RAMSAY HUNT, New York, read a paper entitled, "Preliminary Report on a Cortico-Neural and a Strio-Neural Motor System in Peripheral Nerves."

A discussion of the evidence indicating the existence of two distinct physiologic systems of motor fibers for the conduction of efferent impulses in peripheral nerves.

1. A system for the conveyance of motor impulses, subserving the higher functions of motility, as represented by isolated synergic movements of cortical origin.

2. A system which is phylogenetically older for the passage of motor impulses, of striospinal origin, subserving the function of automatic and associated movements.

The corticoneural system is related to the pyramidal tract system, and dissociated movements of cortical origin.

The strioneural system is related to the extrapyramidal motor system, and associated movements of striatal origin. A consideration of this conception of the final common path and its relation to problems of reeducation and regeneration after injuries of peripheral nerves.

DISCUSSION

DR. ISRAEL STRAUSS, New York, asked whether he understood Dr. Hunt correctly that the musculospiral nerve, in the case he first cited, was cut across and that there was no regeneration of fibers, because if that is the case how does he explain the impulse coming down through the peripheral nerve to this muscle if this muscle has been destroyed. How can an impulse even from the corpus striatum come down to this muscle if this nerve is destroyed? Unless he wishes to assume that possibly some of these impulses come out by way of the sympathetic system to the muscle group, which is taught by some.

DR. ELMER E. SOUTHARD, Boston, read a paper entitled, "An Extension of the Key Principle of Diagnosis to the Genera in Certain Great Groups or Orders of Mental Disease."

The reader presented, along the lines of the key principle offered to the association last year, some applications to the main subdivisions of the chosen groups (syphilitic, feeble-minded, epileptic alcohol, drug and poison, focal encephalic, somatic (nonnervous), senile-senescent, schizophrenic, cyclothymic, psychoneurotic, and residual psychopathic). The plan is that in the logical analysis for diagnostic purposes of data that have already been collected in a given case, there shall be an arbitrary confrontation and elimination or choice of genera in a certain selected order. The principle of precedence in this order is the practical principle of availability and reliability of tests and symptom groups.

The reader offers not so much a new classification of mental diseases as a method of arriving at a diagnosis of some one of the recognized entities. The principle is perfectly applicable, for example, to the group of entities worked out by the American Medico-Psychological Association and adopted by the Surgeon-General, U. S. A.

DISCUSSION

DR. LEWELLYS F. BARKER, Baltimore, said he was very glad to hear this paper by Dr. Southard and to participate in the discussion. He thought a great deal more attention should be paid to these logical considerations in diagnosis. It seemed to him that Dr. Southard had done us a distinct service in bringing the subject forward. He hoped that in succeeding meetings he would have more to say about the subject of logical diagnosis. It is a subject to which Dr. Barker had given a good deal of thought in connection with clinical teaching and in consultation practice. In December, 1917, in an address before the New York Academy of Medicine, he had himself dealt with this subject. The order to be followed in medical diagnosis is really the order that is followed in all reflective thinking. There is a series of steps in all reflective thinking. In the first place we are confronted by a problem to solve. We feel a perplexity. The second step is to suspend our judgment until we collect enough data to localize and more accurately define the diagnostic problem. We teach students to make a general physical and psychical examination, to have a certain number of roentgen-ray tests made, to make a series of laboratory tests and to call on specialists in particular domains (rhinologists, ophthalmologists, dentists, orthopedists, neurologists, psychiatrists, gynecologists, etc.); and only after we have gathered the data together are we prepared in the more obscure cases to localize our diagnostic problem. After getting the data together, the next step is to arrange the data according to their similarities and sequences. It is helpful to arrange the findings then according to systems—circulatory, respiratory, digestive, urogenital, locomotor, nervous, metabolic, endocrine, etc. In the collection of facts by observation one does not allow himself to think too much of the final diagnosis. After collecting the data, we stop observing temporarily and begin to think, and that is a process in which diagnosticians differ most—in Dr. Barker's opinion. We allow suggestions of solution of the diagnostic problem to occur to us; we leap from the facts to inferences. Some of us, in this process, have too many suggestions. Others of us have too few. The best kind of diagnostic mind is one in which a sufficient number of possible suggestions of solution occur, but not too many. After we have permitted these suggestions to occur we take the next step;

we reason about them; we see what are the full bearings and implications of each of the suggestions. If the idea of typhoid fever occurs to us we recall our knowledge of the disease gained from our own experience and from the literature and see whether the data before us correspond with it. If the idea of schizophrenia occurs to us, we ask ourselves what the findings might be if the idea is a correct one, and compare the actual findings with these. Very often further observation and experiment may become necessary in order to institute a satisfactory comparison. We may find that we have to make a multiple diagnosis to account for all the deviations from normal function that are present. By testing inferences, rejecting some and corroborating others, we arrive at a concluding belief. That is the series of steps: A feeling of perplexity, the localizing of the problem, the arrangement of the facts, the allowing of suggestions to come up in our mind as to interpretation, reasoning about these suggestions, further observation and experiment to test them, and final arrival at a concluding belief. If we follow this method of diagnosis conscientiously we shall get as good results as our knowledge and training will permit. It is some such plan as this, Dr. Barker felt sure, that Dr. Southard wishes to have followed.

DR. ELMER E. SOUTHARD, Boston, wished to thank Dr. Barker for discussing his paper so kindly. He was glad to agree with him that diagnosis did not consist in the process of collecting data. He thought that most books on physical diagnosis had no more to do with the process of diagnosis than had the law of gravitation. If you teach a man how to percuss and auscult, you are not teaching him how to make a diagnosis; you are teaching him how to collect data to use in the process of making diagnosis. A great deal that the books call diagnosis was *gnosis*.

As to Dr. Barker's interesting method of diagnosis by localization, taking up cephalic, thoracic, abdominal, pelvic, brachial, pleural loci of disease, or taking up diseases from the standpoint of systems like the respiratory and secretory systems, Dr. Southard was inclined to consider that much of interest and value lay in Dr. Barker's method. However, he felt that the method could not be generalized and that precisely in mental diseases one would be at a loss if one confined himself to this localizing method. Much damage had accrued to psychiatry from the notion that mental disease is necessarily brain disease. Where, for instance, would personality be localized? One would surely need to take into account not merely the neurones but also the hormones, for whose importance Dr. Barker had pleaded so cogently of late.

Dr. Southard had brought general contentions of this sort before the Association of American Physicians. He would refer interested persons to the forthcoming paper.*

DR. SAMUEL T. ORTON, Philadelphia, read a paper entitled, "Histological Evidence of the Path of Invasion of the Brain in General Paresis."

Anatomic survey of the distribution of the lesions in paretic brains shows them, in the majority of cases, to reach their greatest severity in the areas fed by the branches of the internal carotid. In rare cases the greatest intensity is found in the area of distribution of the basilar artery (Lissauer's paresis). These facts suggest the vessels as the path by which the spirochetes reach the brain.

* A paper shortly to be published in the *Journal of Clinical and Laboratory Medicine*, entitled: "Diagnosis per Exclusionem in Ordine."

The histopathologic evidence which alone accurately substantiates the diagnosis of paresis is not the destruction of the brain parenchyma but the widespread periarterial infiltration of lymphocytes and plasma cells. This has led to an investigation of the larger intracranial vessels before they penetrate the brain substance with the finding of lesions here in some cases comparable with those of the intracortical vessels. The lesions of the intracortical vessels are also quite similar to those described in syphilitic aortitis.

The development of the psychosis heralds the invasion of the brain parenchyma from the foci of chronic infection in the mesodermal vascular structures and its type is probably dependent on the balance between the destructive and irritative effects of this invasion.

The psychosis may be compared to the stage of cavity formation in pulmonary tuberculosis and the most hopeful time for treatment of general paresis is before the psychosis develops, that is, in the interval of years which occurs between the infection and the final brain invasion.

DISCUSSION

DR. S. P. KRAMER, Cincinnati, said that some years ago he was able to demonstrate in the living animal that the blood supply of the brain under physiologic conditions was divided into a carotid and a vertebral area, and that the blood going to these areas did not mix. He had for some years thought that syphilis of the nervous system was a metastatic process, secondary to end arterial syphilitic patches. That the incidence in a given case of paresis—bulbar, syphilis or caused by *tabes dorsalis*—might be determined by the location of the aortic syphilitic patches; which location might determine whether the syphilitic "emboli" were swept into the carotid, vertebral or spinal arteries. To this end he had asked the pathologist at Danvers' Hospital to save the aortas in cases of syphilis of the cerebrospinal axis and hoped at some future day to report the results of the examination of the material.

DR. LA SALLE ARCHAMBAULT, Albany, read a paper entitled, "Parenchymatous Atrophy of the Cerebellum."

Report of the case of a man who first came under personal observation at the aged of 56, presenting marked evidences of disordered cerebellar function. The onset dated back some twenty years or more, and all the symptoms had appeared very gradually and slowly increased in severity. The patient remained under observation for a period of almost eight years and eventually died of lobar pneumonia. A very complete examination of the entire central nervous system was made.

The clinical picture was characterized essentially by the following manifestations: cerebellar titubation, antifixion of the trunk with tendency to anteropulsion, abduction of the lower extremities and oscillations of the trunk while standing, more or less marked rigidity of the trunk and lower extremities, intention tremor of the head as well as of the upper and lower extremities, dysmetria and slight asynergy in the movements of all the extremities, but more marked on the right side, increased tendon reflexes without ankle clonus or Babinski phenomenon, slight nystagmic oscillations of the eyeballs on lateral excursion, slow and monotonous articulation with somewhat nasal intonation, but without definite scanning. Trophic functions, general sensibility and special senses normal.

Anatomic Findings: The entire cerebrospinal axis was normal with the exception of the cerebellum which presented a marked and perfectly sym-

metrical atrophy. Careful measurement showed that the volume of this organ was reduced approximately one-third. The brain-stem was examined by means of serial sections from the posterior wall of the third ventricle to the level of the motor crossway. The lesions were strictly limited to the cerebellar cortex, involved both the vermis and the hemispheres and were generalized though not everywhere of equal intensity. The lobules of the inferior surface of the hemispheres and of the inferior worm were less diseased than those of the superior surface. The right hemisphere was more seriously involved than the left. The most extreme changes were found in the superior worm and in the quadrangular lobules. The histologic lesions in the cortex consisted of atrophy of the molecular zone, disappearance of the Purkinje cells, atrophy and rarefaction of the granular layer. There was only moderate neuroglial hyperplasia, no vascular foci anywhere within the cortex, but vascular changes were found in the pial folds intercalated between the cerebellar folia. Lantern-slide demonstration of the brain-stem sections.

DISCUSSION

DR. LEWELLYS F. BARKER, Baltimore, said that the histologic picture presented was most interesting. The thing that impressed him most of all was the slightness of the changes outside of the cerebellum and especially the absence of changes in the nuclei dentati and in the brachia conjunctiva. Were there any changes in the cord at all? Did Gowers' tract show any changes?

DR. J. RAMSAY HUNT, New York, said that to him this was a very interesting contribution because of the relation of intention tremor definitely proven anatomically to have a connection with the cerebellum. Three years ago, before this association, Dr. Hunt reported what he thought was a new system disease related to the cerebellum. The affection was a gradual development of intention tremor extending over a series of years. It was the sole and only symptom. An analysis of the intention tremor, however, showed that it contained many of the components of a cerebellar disturbance, such as asynergia, certain forms of asthenia, Gordon Holmes' symptom and the like. Dr. Hunt christened this disease asynergia. He expressed the belief that it was due to the loss of the system in the neocerebellum, a system which has some control over voluntary movement and when this system is interfered with there results a curious hyperkinesia defect. Dr. Hunt said he would probably not have an opportunity to examine such a case as he had described. These cases are very rare and it would be only a peculiar conjunction of circumstances that would permit him to follow out to the end such an idea, but the presentation by Dr. Archambault made him feel very certain that we have in the cerebellum a system which, in pathologic change, may produce intention tremor, that intention tremor is intentionally and fundamentally a cerebellum symptom, and that asynergia progressiva is a definite disease.

DR. ELMER E. SOUTHARD, Boston, said that Dr. Archambault's case, while, of course, of unusual interest anatomically, had interested him clinically. Many of the symptoms in Dr. Archambault's case were symptoms of the group which Dr. Southard had tried to collect under the name "symptoms of hyperkinesia by defect." Catalepsy was such a symptom. One was reminded of the contentions of Kleist about the relations of the fronto-cerebellum apparatus to catatonia. There was too much of a tendency in neurology to feel that if a neuron got killed and lost out of an apparatus, there must be a constant and uniform symptomatic result in the form of some particular paralysis. In point

of fact, organic lesions produced very variable clinical symptoms just because the effects are largely due to processes going on in the tissue that is left behind. This was the meaning of the concept of hyperkinesis by defect, a concept illustrated in the simplest way by the excess knee jerks of pyramidal tract disease.

Dr. Southard was astonished that there was so little fibrillar gliosis in a case presenting such extensive parenchymatous disorder as did Dr. Archambault's case. Probably there was a considerable cellular gliosis in the Purkinje cell belt, a region which is frequently subject to a kind of rarefaction.

DR. THEODORE H. WEISENBURG, Philadelphia, said that he had been very much interested in Dr. Archambault's paper, but that he could not agree that catalepsy is a symptom in cerebellar disease. Dr. Mills and also Dr. Weisenburg had made a study of this subject and found the opposite to be true. For example, in a right-sided cerebellar case the patient was able to maintain the position longer on the normal side than on the diseased side. If he was not mistaken Babinski had republished the original case in which this observation on catalepsy was made; he found that the case was now purely cerebellar. He could not agree with Dr. Hunt that intention tremor is a cerebellar symptom, and believed it was a manifestation of asynergy. He could not help but believe that tremor, if studied carefully by the slow moving picture method, would reveal other findings.

DR. LA SALLE ARCHAMBAULT, in closing the discussion, said in answer to Dr. Barker that the only secondary degeneration observed was found in the zone bordering on the lateral aspect of the corpus dentatum and in the deep white matter located behind the nuclei tecti. There were no secondary degenerations in the cord, although the marginal layer occupied by the direct cerebellar tract and the anterolateral ascending tract of Gowers presented a slightly less intense coloration than the other tracts of the lateral columns. Dr. Archambault thought that this was simply due to retrograde atrophy, as there was no compensatory or secondary gliosis. Dr. Southard brought up the question of gliosis in the cerebellar cortex. Regarding this point, it was stated that a very definite hyperplasia of glia cells was observed in the molecular zone, but no appreciable proliferation of glia fibrils was seen anywhere. As to the objection raised by Dr. Weisenburg concerning the significance of cerebellar catalepsy, it was not maintained that catalepsy was a diagnostic symptom of cerebellar disease, but nevertheless it was a valuable sign and was present in three of Babinski's patients whom the author had had the privilege of seeing. It should be remembered that Babinski insisted on the fact that wide oscillations of the thighs first occurred before immobility was attained and then maintained often for an incredibly long time. Dr. Archambault's patient had exhibited this symptom with extraordinary perfection. As regards intention tremor, he had read the reprint of Dr. Mills and that of Dr. Weisenburg and remembered that these authors regarded tremor, dysmetria and adiadochokinesis as manifestations of asynergy, which is unquestionably correct, but however we are to interpret the nature or genesis of the tremor, the fact remains that intention tremor is one of the cardinal symptoms of cerebellar disease.

DR. S. D. W. LUDLUM, Philadelphia, read a paper entitled, "The Doctrine of Neutrality and Its Relation to Mental Disorder."

The paper gave an account of tests made to determine the degree of acidity or alkalinity in the fluids of the body when mental disease is present.

DISCUSSION

DR. M. ALLEN STARR, New York, asked whether there were any clinical parallels between the cases of alkalinity or acidity; that is, if there was any particular form of mental disturbance which showed itself in one or the other state. Was melancholia present in the alkaline person and mania in the acid person?

DR. ALFRED GORDON thought it might be of interest to Dr. Ludlum to know that he had investigated several cases of epilepsy from his standpoint. He examined for chemical reactions not only the urine and saliva, but the blood and spinal fluid. When the chemist reported high alkalinity he gave hydrochloric acid systematically. The spinal fluid and the blood were examined two or three weeks later. There was considerable reduction in the alkalinity and there was a great diminution of the intensity and frequency of the epileptic seizures. Dr. Gordon said he would report particularly one case of a young fellow, aged 23, who used to have attacks of epilepsy daily. For a period of two weeks he did not have a single attack. Dr. Gordon said he did not mean to refer to this as a direct relation, but it was exceedingly interesting in connection with Dr. Ludlum's investigation in mental diseases. Dr. Gordon asked what Dr. Ludlum understood by the neutral. He said he did not suppose that he meant that the cerebrospinal fluid could be made other than alkaline. He said he would like to get Dr. Ludlum's view on that particular phase.

DR. EDWARD M. WILLIAMS, Sioux City, Iowa, read a paper entitled, "Case of Hyperpyrexia of Doubtful Origin."

The case was that of a woman, aged 25, who was examined Jan. 15, 1916, and found to have an acute otitis media on the right side; a paracentesis had been performed in December, 1916. A simple mastoid infection occurred later for the relief of which paracentesis was again performed Feb. 5, 1918; a fistula in the right mastoid was exposed which led to the dura in the superior fossa with apparently a large cavity in the brain tissue—presumably a brain abscess. An apparently good recovery followed. The middle of March her temperature during the first few days was from 101 to 103; later from 107 to 110 F. Temperature increase recurred daily at definite periods following chills and vomiting. The rectal and oral temperature were usually taken with approximately the same relative result. The pulse never was above 114; blood examinations were all normal. A question of hysterical elevation of temperature was considered, but there was absolutely no opportunity for the patient to use any heat appliances.

DR. CHARLES S. POTTS, Philadelphia, said that Dr. Mills and Dr. Dercum might remember a woman who from 1882 to 1890 was a well known hospital rounder in Philadelphia. She was in the Philadelphia Hospital, and came under Dr. Potts' care while he was an intern there. During that time she represented very much the same condition that Dr. Williams has spoken of, having a temperature of from 107 to 110 F. for over a week. It was impossible by every means he could use to detect her manipulating the thermometer. The temperature was taken in the rectum, axilla and mouth, and it always very closely corresponded. She was a case of probable hysteria with a marked morbid desire for notoriety. She frequently would get a convulsion in the street car, and practically every hospital in Philadelphia had been visited by her.

DR. M. ALLEN STARR, New York, said he had seen a similar case at the New York Hospital several years ago in which there was a temperature of 108 F.

DR. ISRAEL STRAUSS, New York, read a paper entitled, "Trauma and Its Relation to the Development of Glioma of the Brain."

A brief résumé of the history of five cases of gliomas, in which the symptoms appeared shortly after head trauma. Discussion of the influence of trauma in the development of tumors in general.

The susceptibility of ectodermal tissue to tumor formation as the result of irritation.

Are the symptoms of brain tumor appearing shortly after trauma due to hemorrhage in a latent glioma, or to an induced rapid growth of the tumor, or to the formation of a tumor?

DR. S. P. KRAMER, Cincinnati, read a paper entitled, "Palliative Trephining in Cases of Tumor of the Infundibular Region."

A discussion of the most favorable site for so-called decompression in tumors of the infundibular region for the particular purpose of relieving pressure on the optic nerves. The site of such operation ought not to be determined by cosmetic consideration. Pressure caused by tumor does not depend on hydrostatic pressure. A discussion of the physical principles involved.

DR. N. S. YAWGER, Philadelphia, read a paper entitled, "Hypnagogic Hallucinations with Cases Illustrating These Sane Manifestations."

GENERAL NEUROLOGIC AND PSYCHIATRIC PROBLEMS IN MILITARY SERVICE

1. "So-Called 'Shell Shock.'" The Remedy. DR. FRANCIS X. DERCUM, Philadelphia.

2. "Shell Shock." LIEUT.-COL. COLIN K. RUSSEL, Canadian Army Medical Corps.

3. "On the Nature of Nervousness Among Soldiers." MAJOR FOSTER KENNEDY, Royal Army Medical Corps.

DR. CHARLES L. DANA read this paper for Major Kennedy, stating that Major Kennedy was unable to be present because he has been working in a base hospital in France.

DISCUSSION

DR. HERMON C. GORDINIER, Troy, N. Y., asked Colonel Russell whether he had noticed any evidences of hyperthyroidism in any soldiers suffering from shell shock, and whether blood pressure observations were made in these cases.

DR. M. ALLEN STARR, New York, said that along that same line he would like to ask Colonel Russell whether examinations of the urine, or of the blood had been made. He would like to know whether, if the blood examinations were made, they gave support to the facts brought out by Cannon in his lectures at Harvard on the effect of fear and anger in animals in the production of an increase of blood sugar and the production consequently of glycosuria. He wished to know whether any observations of that kind had been made in these cases.

DR. H. R. STEDMAN, Boston, said he would like to know what happened when a man had a second attack of shell shock after being sent back to the front, and how many such attacks were thought to unfit him for military service.

DR. FRANCIS X. DERCUM, Philadelphia, said that he felt, too, that he had not time to discuss the pathology of hysteria in detail; merely to bring forward its essential features. That in hysteria we have various visceral phenomena there can be no question. When the cortical centers lose their domination the lower mechanisms go off, so to speak, by themselves. Sometimes there is tachycardia, or other vascular disturbance. Sometimes there are symptoms presented by the gastro-intestinal tract; sometimes by the sweat and other glands. There are many variations in the clinical picture; but the important point to remember is that all of the symptoms may be correlated by suggestion, as has just been illustrated by the accounts of cases in the papers read by Colonel Russell and Major Kennedy.

DR. THEODORE DILLER, Pittsburgh, said he should like to refute the statement that Colonel Russell made that he is not a psychologist. Dr. Diller thought Colonel Russell had clearly shown he was the best one in the room.

DR. CHARLES K. MILLS, Philadelphia, read a paper entitled "Neurologic and Psychiatric Instruction for Medical Officers."

DISCUSSION

DR. ELMER E. SOUTHARD, Boston, said that the Philadelphia war course in neurology and psychiatry for medical officers was without doubt a better rounded course in many respects than the courses given in the other centers. Naturally, the course had had the benefit of experience in the courses at other centers which had started earlier, but a chief factor was the well known property which Philadelphia had of being a neurologic center and a center with Dr. Mills in it.

The first idea of the National Committee for Mental Hygiene was that there were neurologists enough and that the main thing was to give a brush-up in psychiatry. The psychopathic hospitals in Ann Arbor and in Boston and St. Elizabeth's at Washington were chosen for these psychiatric brush-up courses. It soon appeared that more neurologic brush-up was necessary and the New York and Philadelphia schools were started.

Then shortly came reports from the camps laying emphasis on mental tests, and the dictum went forth that not only psychologists but physicians ought to be able to give these mental tests on occasion.

As to the quality of men sent, some of the material was decidedly inadequate, raising the question whether morons could actually somehow have received medical degrees.

Dr. Southard noticed Dr. Mills' remarks that the Philadelphia course was a practical one, and that some of the courses elsewhere had perhaps been over theoretical, yet the Philadelphia work appeared to have been after all largely didactic. A really extraordinary number of lectures and demonstrations to groups had been given in the Philadelphia course. At Boston they had given almost purely practical work with the actual case material, studying it on staff rounds and at staff meetings. In particular, the psychologic work had been confined to practical test work under supervision. Dr. Southard placed emphasis on the fact that the Boston material was especially good from the standpoint of military work because it did not so much deal with the out-and-out insane as with the near insane and psychopathic groups.

Dr. Mills had rallied Dr. Southard concerning the large number of subdivisions of mental disease (from sixty to eighty-four groups) for which Dr. Southard had undertaken to be responsible. In point of fact, the choice of

from sixty to eighty-four genera of mental disease as the existent genera of today was a research matter which Dr. Southard had just brought before the American Neurological Association. The major groups of mental disease were, according to Dr. Southard, very few in number—not more than 10 or 11—and they were virtually identical with the material found in all the best American textbooks. Seriously speaking, Dr. Southard did not feel that the charge of being over theoretical was properly to be brought against the Boston course.

Dr. Southard emphasized the importance of getting neurologic and psychiatric interns for the rapid development of proper neuropsychiatrists for the Army, intrabellum and postbellum.

Finally, Dr. Southard said he was glad to get the Philadelphia point of view, and knew it covered the ground well, though possibly it was a bit theoretical.

DR. FRANCIS X. DEKUM said that he personally knew the course as given in Philadelphia was very practical. Dr. Mills' article also emphasized the fact equally that along with organic neurology the psychoneuroses have been taught elaborately and with great wealth of material.

COL. THEODORE C. Lyster said that if he could as ably defend the Surgeon-General's Office as Dr. Southard had Boston teaching he would be happy. As to medical officers, they did not have many Campbells to protect the front lines, so these cases (so-called shell shock) did not get back. The difficulty of supplying that very class of men at this time is probably the best reason why such men could be utilized if they could be spared for this class of work. Then the question comes: How far can you train that clinical man for his work? Certainly, if you try to make him a neurologist, as just one feature of his education, then try to add to that the various conditions actually met with—we know that was impossible at the start and is impossible now. Of course, team work is the only way that it can be approximated. Careful work in the physical examination and care of men at the front. One of the earliest reasons that existed for the establishment of the neurologic school which Dr. Frazier has so ably handled in Philadelphia, was that they realized that neurologic surgeons would be sadly needed at the front. The subject has been developed far enough to call on the civilian medical men to supply the necessary personnel. They were anxious to at least have one or two neurologic men placed at these front points to help out with these undetermined diagnoses, even to help that man who by training could perform all the functions of a well grounded man. It ended in a course of instruction being established which, while it met the immediate needs, had to be necessarily of a limited character. From this school they had hoped to train—rather supplement the training of neurologic surgeons to make up surgical teams both in this country and abroad. The Surgeon-General's position is that while he is willing to urge the early induction of medical interns into the various schools that are supposed to lead to special training, it should be remembered that the number of desirable men available is naturally far below what it should be. They will feel safer when they know most of the branches that they desire are represented.

DR. CHARLES K. MILLS, in closing the discussion, said that as far as he knew Boston, with regard to neurology, medicine or anything else, has never yielded, in its own mind at least, its position as the "Hub of the Universe." He still supposed that the rest of us should be regarded as spokes in Boston's hub. Dr. Mills thought it was unfair for Dr. Southard to say that 90 per cent. of

the teaching in Philadelphia was didactic. Dr. Mills should say probably only 30 per cent.—and that largely anatomic and pathologic. The Philadelphia instructors had continuously exhibited patients and had, so far as possible, had the students examine cases. Dr. Mills said he did not know exactly what Dr. Southard meant, but he could not conceive that the doctor had students in his psychiatric wards and had allowed them to go around in his presence without talking to these students. In Philadelphia, in addition to allowing students to do much work for themselves, this is what has been done.

COL. PEARCE BAILEY, New York, read a paper entitled, "Work of the Division of Neurology and Psychiatry."

This paper was profusely illustrated by lantern slides and given with closed doors.

MAJOR GRAEME M. HAMMOND, New York, read a paper entitled, "Neurology and Base Hospital Work."

MAJOR MENAS S. GREGORY, New York, read a paper entitled, "The Examination of the Recruit and Cantonment Work."

DR. CHARLES L. DANA, New York, read a paper entitled, "Reconstruction Problems in Neurology and Psychiatry."

MAJOR ROBERT M. YERKES, Washington, D. C., read a paper entitled, "Psychological Examining in the United States Army."

DR. M. ALLEN STARR, New York, said that Dr. Hammond and Dr. Bailey had shown the need of medical officers in the Army, the intense need of them, and we know that in *The Journal of the American Medical Association* recently the Surgeon-General has put out an appeal for the enlistment of further medical men in the Army. Dr. Hammond has told us that, if the order of Dr. Bailey is carried out, one man only will be assigned to a base hospital, and that man will be overworked in every way. Now Dr. Starr would like to ask Dr. Bailey as the colonel of this division, to let us know why it is that the Army medical department refuses to accept the services of many of us who, though beyond the age and probably wholly incapable of passing these examinations which we have heard about, yet are still of fair amount of use in the world and are exceedingly willing and very anxious to give our services to the government. We all know that in the hospitals of this country there exist consulting boards—consultants who are called on by the attending physician or by the intern to come in and help along for diagnosis in cases in which there is a doubt. These men are not limited in their service to the hospital, although in Dr. Starr's experience they are willing to go day or night voluntarily to fulfill their duties. Now it seemed to him that here in this organization we have 200 men and we have been told that only twenty-two are in the service. We have 200 men whom Dr. Starr was sure were in no way deficient in patriotism, and it seemed to him that the government could make use of them, and if there was, as we are told, this deficiency in the material that the government ought to make use of us; and yet he thought that it was not incumbent on us to offer our services, which would undoubtedly be declined on account of our age, for full, continuous, active and constant labor. The thing had been brought to the attention of Dr. Starr particularly through the statement by Dr. Hammond. There was the camp where Dr. Hammond was in service, three-quarters of an hour or an hour by automobile from New York. In New York there were certainly twenty-five men who would willingly serve in that camp as consultants three or four hours

every day, or twice or three times a week, as the case might be, and Dr. Hammond's labors would thereby be markedly lightened. If Dr. Hammond needs six men every day, and he is there alone, why should not he have five men to come up every day and help him out? Dr. Starr said he had put this matter before the members of the association because he thought the members ought to express formally their willingness to put their services at the aid of the government, and have it understood that the government can call on them for services of this kind as consultants or as active attending physicians for certain times, if not constantly. Now this was not a new thing. We know perfectly well that in the hospitals of Paris and all over France, in the hospitals of London and all over England, medical men—Sir William Osler, for instance—are acting in this capacity. There are men of every age and standing who are giving their services, and whose services are eagerly accepted. Dr. Starr said he would like to have Colonel Bailey, if he can, make some statement as to why the government of the United States should not so use members of the American Neurological Association.

GEN. THEODORE C. Lyster, Washington, D. C., read a paper entitled, "The Work of the Aviation Section, Signal Corps, U. S. A."

COL. GEORGES DREYER, Royal Army Medical Corps, read a paper entitled, "Medical Aviation Problems in Active Service."

MAJOR STEWART PATON, Princeton, N. J., presented a paper entitled, "Psychiatry and Aviation."

LIEUT.-COL. WILLIAM H. WILMER, Washington, D. C., presented a paper entitled, "The Eye and Aviation."

MAJOR EUGENE R. LEWIS, Dubuque, Iowa, read a paper entitled, "The Ear and Aviation."

Book Review

LES BLESSURES DE LA MOELLE ET DE LA QUEUE DE CHEVAL.

By GUSTAVE ROUSSY, Professeur agrégé à la Faculté de Médecine de Paris, and Jean Lhermitte, Ancien chef de Laboratoire à la Faculté de Médecine de Paris. Pp. 202, avec 8 planches hors texte. Paris: Masson et Cie, 1918.

What the French in their expressive language and graphic way have called *la neurologie de guerre* stands as one of the war monuments to this remarkable people. How the neurologists of France aided their government in its organization of the medical service for proper care of the nervously and mentally sick; with what patience and success they investigated the manifold injuries of the nervous system, and with what astuteness they quickly recognized the psychoneuroses and promptly cured most of them, are already matters of record—imperfect record to be sure. In these divers activities Roussy and Lhermitte have played no inconsiderable rôle, and the present little volume is one of the fruits of their labors.

As Pierre Marie says in his preface of the present work, to see a large number of cases of trauma of the cord, to observe them immediately after the injury and then follow them for weeks and months; to have the opportunity for painstaking clinical investigation and for microscopic postmortem examination; and also be qualified to do both clinical and pathologic work in magisterial way, surely is given to few men. These exceptional advantages were those of the authors of this book.

It is divided into four parts: I, Injuries of the Spinal Cord (117 pages); II, Lesions of the Cauda Equina and Conus (27 pages); III, Complications (29 pages), and IV, Treatment (10 pages).

The first part treats of (1) complete division of the cord; (2) incomplete division; (3) pathologic anatomy; (4) concussion of the spinal cord, and (5) diagnosis of cord injuries. All injuries are considered from the chronological standpoint, the importance of which is often not appreciated. Immediately after the trauma, injuries of vastly different significance may present almost identical clinical pictures. Also, the various injuries are considered with reference to the different levels. Not only do the authors consider complete and partial Brown-Séquard paralysis, but describe a new type of partial division—posterior hemisection.

One of the most interesting chapters in the book is that on concussion of the cord (*les commotions spinales*). But concussion is scarcely the proper word for the conditions described. Contusion would be a better word, but contusion in the sense of mass perturbation. The carefully detailed symptoms as well as the microscopic findings (well illustrated) will be a revelation to many readers.

To devote one whole part of the book to complications was a happy thought. For their importance needs to be impressed on internist and surgeon. "Often the prognosis depends more on the complications than on the cord lesion." We believe that relatively few medical men appreciate the why of these complications and are familiar with the means of their prevention.

In the section on treatment, as regards injury of the cord the position of the authors is that of great conservatism, for which they give cogent reasons. Injuries of the cauda are quite another matter and surgical intervention is much oftener advisable. Finally they give the conclusions of the interallied surgical conference on injuries of the spinal cord.

Although the book is based on war work, it has lost little of its value. The mechanism of trauma of the cord is always the same, and the accidents of civil life often are similar to those of military activity. The means of diagnosis, including localization, remain as they were. War and its hazards alter neither anatomy, physiology nor pathology. Given a certain condition of the cord and its surroundings, the treatment indicated is identical whether the remote cause was malignant intention, human frailty or celestial oversight. Roussy and Lhermitte have given us a timely and most useful monograph.

Archives of Neurology and Psychiatry

Vol. I

FEBRUARY, 1919

No. 2

A CASE OF OCCLUSION OF THE POSTERIOR INFERIOR CEREBELLAR ARTERY WITH CARDIAC MANIFESTATIONS AND INVOLVEMENT OF THE LEFT VAGUS NUCLEUS*

LOUIS HAUSMAN, M.D.

NEW YORK

The typical syndrome which this case presents and the unusual cardiac complications which it manifests, have an important bearing on certain physiologic problems with regard to the course of the sensory tracts in the medulla, and the influence of the vagus on the heart action.

REPORT OF CASE

History.—L. A., a man, aged 48, born in Austria, was admitted to the Neurologic service of the Mount Sinai Hospital, May 29, 1918, complaining of persistent hiccough.

His present illness began gradually five days before admission (Friday). He had felt perfectly well that day until the evening, when he experienced the sensation of nausea and fatigue immediately after finishing a heavy meal. He sought relief by going to bed. The next morning (Saturday), despite a good night's rest, this feeling of nausea persisted. In addition he developed subjective dizziness, which was aggravated by sitting and walking. His gait became unsteady, and he occasionally staggered as if drunk. He experienced marked fatigue. He suffered no headaches, nor at any time did he have any loss of consciousness. The following morning (Sunday), while being shaved at the barber's, he was suddenly seized by a queer sensation; he felt as if his body were being cut in half by a sharp knife. He immediately returned home without assistance and took to bed. That afternoon he began to hiccough, and this has since been the most persistent and annoying symptom of the disease. The next day (Monday), he became very weak and had to be helped about. His voice suddenly became hoarse and rasping in quality. His hiccough ceased spontaneously for about half an hour. He began to complain of coldness in both legs, and a dull nonradiating pain in the right arm. He had no visual auditory, olfactory or gustatory disturbances; no vesical or rectal disturbances, no dysphagia or vomiting.

His past history presents the usual diseases of childhood; typhoid twenty years ago and asthma for the past fifteen years. He is a man of temperate habits, smoking but little and taking alcohol in moderation. He denied venereal disease by name and symptom. He was a furrier twenty years ago, in which

*From the Neurological Service of the Mount Sinai Hospital, New York.

occupation he was engaged for five years. He has since led an easy and quiet life.

About four years ago he experienced right lumbar pain, with difficulty in micturition, but without hematuria. The diagnosis of nephrolithiasis or nephritis was made by a physician. Until one year ago he had no frequency of urination; since then, however, he has been compelled to void six times a day and once at night. He has had no pruritis, polydipsia or polyphagia. Urinalysis in 1913 was reported negative.

The earliest premonitory symptoms of his present illness made their first appearance six months ago, when he began to develop a dull nonradiating pain in his right arm, and became subject to attacks of dizziness and staggering. These attacks were at no time associated with loss of consciousness. At first they visited him but once a fortnight, and were very short in duration, lasting usually no more than a few minutes. Just before the onset of his present condition, they became more frequent, occurring twice in one week.

His family history, otherwise irrelevant, reveals the fact that his sister has had diabetes for many years.

Physical Examination.—The patient is an obese, gray-haired, middle aged man who is incessantly hiccoughing. His general condition is fair; he is uncomfortable, and hesitates to sit up on account of fear of producing an attack of vertigo. He is intelligent; his attention is good, but his memory is very poor. His voice is hoarse and rasping in quality.

The face shows a slight weakness of the left side. The left palpebral fissure is narrower than the right. There is a subacute conjunctivitis present in his left eye. The corneal reflex was found to be absent on that side and sluggish on the right. The pupils are unequal; the left is smaller than the right and also irregular in outline. They both react briskly to light and accommodation. All ocular movements are normal in range. In the extreme position there is a slight horizontal nystagmus, especially on looking to the right. All movements of the jaw are normal. The teeth and gums reveal a marked pyorrhea alveolaris. The tongue protrudes in mid line and presents a fine fibrillary tremor; there is no atrophy. The palate moves freely. The uvula is in midline. The left vocal cord is paralyzed (left recurrent palsy). There is no difficulty in swallowing. The pharyngeal reflex is absent on both sides.

Special Senses.—Smell, taste, and hearing are unaffected. Visual fields and fundi are normal. The vertical and horizontal semicircular canals were tested by the Bárány method. The ears were douched with cold water of a temperature of 68 F. The following results were obtained:

Stimulation of the left vertical canal produced a marked horizontal nystagmus to the right after forty-five seconds. It did not cause him any vertigo, pass-pointing or nausea.

Stimulation of the left horizontal canal produced a marked horizontal nystagmus to the right. The patient complained of vertigo, but no nausea. The right arm pass-pointed to the left by three inches. The left arm did not pass-point.

Stimulation of the right vertical canal produced a horizontal nystagmus to the left after fifty seconds, which was more marked in the left eye. There was no vertigo or nausea. The right arm pass-pointed 4 inches to the right, whereas there was no pass-pointing with the left arm. Stimulation of the right horizontal canal produced a marked horizontal nystagmus equal to both eyes. The patient experienced slight vertigo, but no nausea. The right arm pass-pointed 1 inch to the right, and the left arm 5 inches to the right.

These tests were done on August 3, and repeated for confirmation nine days later. At both sittings practically the same results were noted.

Motor System.—The movements of the head and trunk are unrestricted. Although the musculature of all the limbs is flabby, there is no atrophy. The motor power on extension and flexion is much weaker in the left upper extremity than in the right. The grasp in the left hand is very much diminished. On attempting to carry out rapid successive movements of pronation and supination, *adiadokokinesia* is manifested in the left hand. There is also some degree of ataxia in that hand, with by-pointing to the left. There is no *asteriognosis* or tremor. The left lower extremity shows a similar degree of ataxia and motor weakness, as compared with the right. There is no restriction in the range of movement of any of the extremities. His gait cannot be tested on account of generalized weakness and marked discomfort.

Reflexes.—The abdominal and cremasteric reflexes are sluggish, the right more so than the left. The left plantar reflex gives a normal flexor response, whereas the right exhibits a tendency to a Babinski and manifests a Chaddock which is suspicious, but not definite. The Gordon, Mendel-Bechterew, Strümpell and Oppenheim reflexes cannot be elicited.

The tendon reflexes in the upper limbs are sluggish, the right more so than the left. The patellar tendon reflexes are sluggish but equal. The ankle jerk is absent on both sides. There is no ankle clonus.

Sensations.—Spontaneous sensations: He complains of a dull non-radiating pain in the right arm. (There are no arthritic changes). The right side feels cold and numb as if dead. These sensations are constant and not aggravated by external agents.

Touch: Light touch, as measured by cotton-wool and von Frey's hairs, and pressure touch, as tested by the pressure esthesiometer, are both perfectly preserved over the face and body.

Localization is perfect on both sides. Roughness is recognized equally well on both sides.

Tickling and scraping: These stimuli, which were used by reason of their affective component, were found to be normal.

Vibration: The threshold for vibratory sense, although diminished, is equal on both sides.

Compasses: He was unable to discriminate two points either when applied simultaneously or in rapid succession on both sides.

Pain: Superficial pain as tested by the pressure esthesiometer and algometer, is lost on the right side of the body and left side of the face.

Pressure pain, as measured by Cattell's algometer, although not lost, is very much diminished on the right side of the body and left side of the face. (Refer to Figs. 1 and 2).

Cardiac Manifestations.—Associated with this neurologic status is the unusual cardiac phase of the disease. The heart is normal in size, shape and position. The rate is slow; the average being 68 per minute. The sounds are of fair quality, and are heard over long periods as a normal rhythmic series, which is occasionally interrupted by extra-systoles, especially after a spell of hiccupping. There are no murmurs. The radial pulses are small and equal, and correspond to the heart's action. There is no pulse deficit.

Clinical Findings.—The systolic blood pressure is 120 mm. of mercury; diastolic pressure is 90 mm. The total and differential leukocyte counts are normal. The blood and cerebrospinal fluid Wassermann tests are negative.

The spinal fluid is clear, under normal pressure and contains seven cells per cm. The urine contains from 2 to 4 per cent. sugar on an ordinary soft diet. The blood sugar is 0.332 per cent. by the Epstein method. The urea nitrogen and the incoagulable nitrogen of the blood and the carbon dioxid tension are normal.

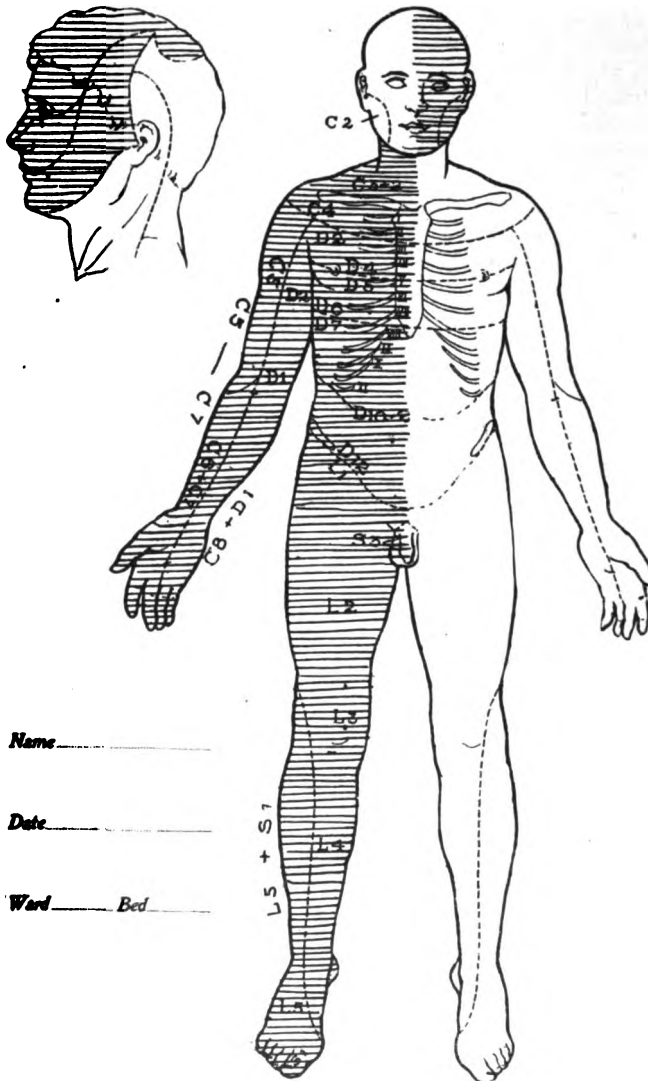


Fig. 1.—Anterior view; sensory disturbances. Shaded areas represent analgesia and thermanesthesia.

Progress of the Disease.—The most annoying symptom has been the almost incessant singultus, which was best controlled by large doses of chloral by rectum. This was the only measure which afforded sleep and relief. On June 8, nine days after admission, the singultus became less marked, and on June 12,

it ceased completely. It has returned at rare intervals, but only for very brief periods and disappeared spontaneously. Temperature: Both epicritic and protopathic thermal sensibilities are lost over the same areas. (Refer to Figs. 1 and 2).

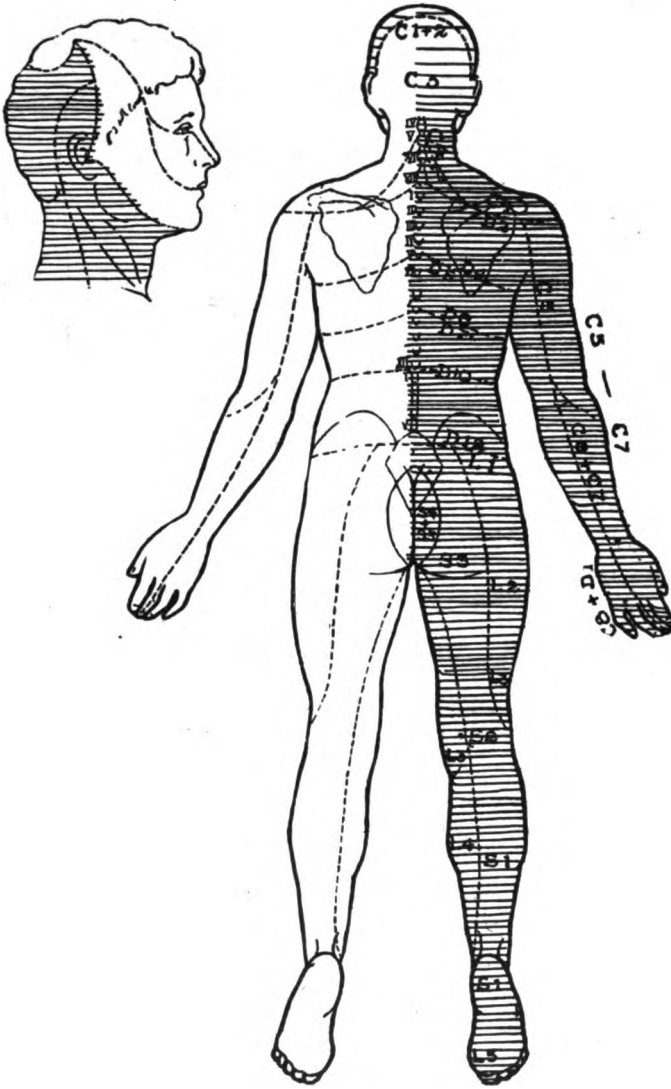


Fig. 2.—Posterior view. Sensory disturbances. Shaded areas represent analgesia and thermanesthesia.

Position: The power of recognizing the posture of any part of the body is unimpaired.

Passive and active movements are normally appreciated.

Weight appreciation is unaltered.

The appreciation of size, shape, form, texture and consistence is normal.

SUMMARY

Face.—Both halves of the face respond equally well to cotton wool and von Frey's hairs, but over the left forehead, temple and cheek, the appreciation of heat, cold, and superficial pain is lost; pressure pain is very much diminished, but not lost. The threshold for vibratory sense, though equal, is lowered on both sides. Two-point recognition is lost.

Body.—All forms of tactile sensibility are perfectly preserved, vibration is appreciated, but diminished, and localization is perfect on both sides. Weight, size, shape and form are accurately recognized. The compass test is impaired on both sides. Over the entire right side superficial pain is lost; the pressure necessary to cause pain is uniformly higher than over similar parts on the opposite side. Over the same area on the right half of the body he is insensitive to all degrees of temperature, and the borders of this loss of sensation correspond to those of the analgesia. Passive and active movement and posture recognition are normal.

The neurologic status has undergone but few changes. The left facial weakness has become more pronounced. On June 15, flattening of left forehead and contracture of the left face became evident. On June 28, wasting on that side was noticed in the region of the masseter muscle, while the jaw was slightly pulled over to the right. The sensory and other changes have remained the same. The cardiac cycle is described in the latter part of the paper.

As the general condition improved, a rigid diabetic regimen was established, and Allen's treatment instituted. He very quickly became sugar-free and has remained so despite a very liberal diet, rich in fats, proteins, and carbohydrate.

GENERAL CONSIDERATIONS

Anatomy.—The posterior inferior cerebellar artery is the largest branch of the vertebral artery. It arises a short distance below the pons and passes obliquely backward around the medulla, at first between the roots of the hypoglossal nerve and then between the roots of the spinal accessory and vagus nerves (Cunningham) toward the vallecule of the cerebellum. As it winds around the medulla, it gives off small terminal arteries to the ventral and lateral aspect, and this region therefore is especially liable to necrosis when the main vessel is blocked. The region affected extends from the point where the inferior cerebellar peduncle begins to pass into the cerebellum, to the middle of the hypoglossal nucleus below. The structures most involved are the greater part of the formic reticularis and its nuclei; the descending root of the fifth and cells in association; the nucleus ambiguus and glossopharyngeal nucleus and their nerves; the ventral and dorsal spinocerebellar tracts, and other tracts (Olivocerebellar), passing into the inferior cerebellar peduncle. The mesial fillet is supplied by twigs from the anterior spinal artery and escapes.¹ The area described is outlined in Figures 3 and 5.

1. Ferrier, David: Albutt and Rolleston System, 1910, 8.

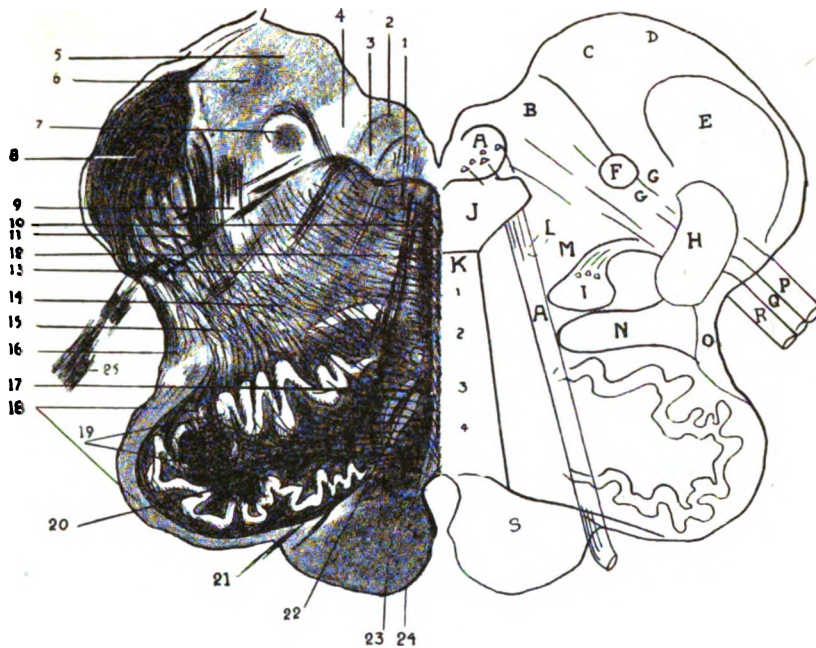


Fig. 3.—Modelled after drawings by Villiger and Edinger. The section passes through the level of the inferior olive. The shaded half presents the histologic anatomy of the region, whereas the schematic half represents the results of lesions in the corresponding parts.

Shaded Area: 1, Nucleus N. XIII; 2, Fasciculus longitudinalis dorsalis (Schütz); 3, nucleus intercalatus Staderini; 4, nucleus alae cinerae s. N. X dorsalis; 5, nucleus vestibularis medialis Schwalbe; 6, nucleus vestibularis lateralis (Deiters); 7, Tractus solitarius and nucleus tractus solitarii; 8, Corpus restiforme; 9, nucleus radices spinalis trigemini; 10, fasciculus longitudinalis medialis; 11, radix spinalis trigemini; 12, substantia reticularis grisea; 13, nucleus ambiguus; 14, fibrae olivo-cerebellaris; 15, nucleus lateralis; 16, tractus Gowers; 17, lemniscus medialis; 18, tractus thalamo-olivaris; 19, oliva inferior; 20, hilus olivae; 21, nucleus hypoglossus; 22, nucleus olivar. accessor. medialis; 23, pyramis; 24, fibrae arcuatae externae ventrales.

Within the substantia reticularis, dorsal to the olive and lateral to the fillet, numerous longitudinal crossing fibers are seen; these may be considered as association fibers, that serve to unite different segments of the medulla oblongata with one another, with higher lying parts of the brain and the spinal cord. Ediger has pointed out that probably within this formatio reticularis run those connecting fibers which associate the facial, vagal and phrenic nuclei to coordinated activity in respiration.

Schematic Half: A, atrophy and paralysis of the tongue; B, slowing of pulse and respiration; C, nystagmus and falling toward side of lesion; D, anesthesia of skin and loss of deep sensibility on side of lesion (which in this section is lower than on corresponding side); E, asynergy on side of lesion; F, ageusia; G, vasomotor disturbance, perspiration, psosis, myosis; H, anesthesia of skin and mucous membranes of head, loss of corneal, etc., reflexes; I, aphonia, difficulty in swallowing; J, impairment of nodding of head and of blinking; K, crossed muscle and skin (?) anesthesia, (1) sacrum, (2) legs, (3) trunk, (4) arms; L, partial crossed head anesthesia; M, loss of tonus and tendon reflexes; N, crossed analgesia and thermo-anesthesia of arms and legs; O, asynergy; P, anesthesia of larynx, etc.; Q, aphonia; R, cardiorespiratory disturbance; S, completely crossed spastic paralysis.

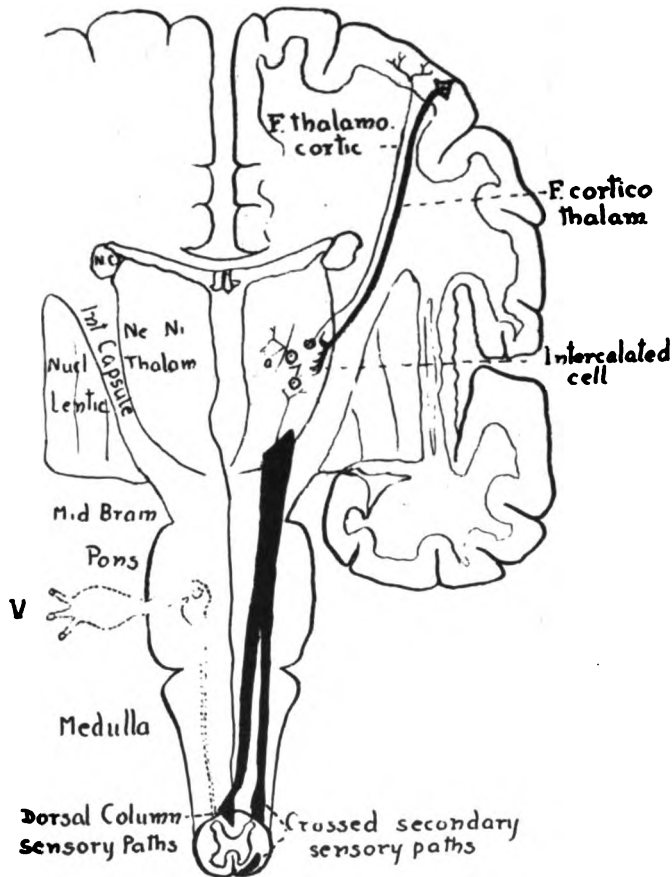


Fig. 4.—(After Head and Holmes.) Represents diagrammatically the anatomic arrangement of the paths and centers concerned in sensation. Two distinct paths exist in the spinal cord; a crossed secondary path in the ventrolateral column which conveys impressions of pain, temperature and touch, and a second uncrossed path in the dorsal columns, which also carries touch and in which run impulses that underlie the sense of position, appreciation of movement, and discrimination of two points and the recognition of vibration, size, shape, form, weight and consistence. This second path decussates in the lower part of the medulla oblongata, but separate from the first path, at least as high as the pons. All these secondary sensory fibers now crossed, terminate in the ventrolateral region of the optic thalamus. The impressions they carry are regrouped here and through neurons are distributed along two distinct paths; the one carries impressions to the cerebral cortex; the other we assume toward the more mesial parts of the optic thalamus. The cortico-thalamic fibers, which terminate in the lateral nucleus of the optic thalamus, are shown.

Sensation.—The brilliant studies of Henry Head and Gordon Holmes² have resulted in a clearer conception of the sensory disturbances from cerebral lesions. The impulses underlying the sensations of pain, heat and cold seem alone to run unaltered, though not uninterrupted, between the upper end of the spinal cord and the optic thalamus. These paths run up in the neighborhood of the nucleus

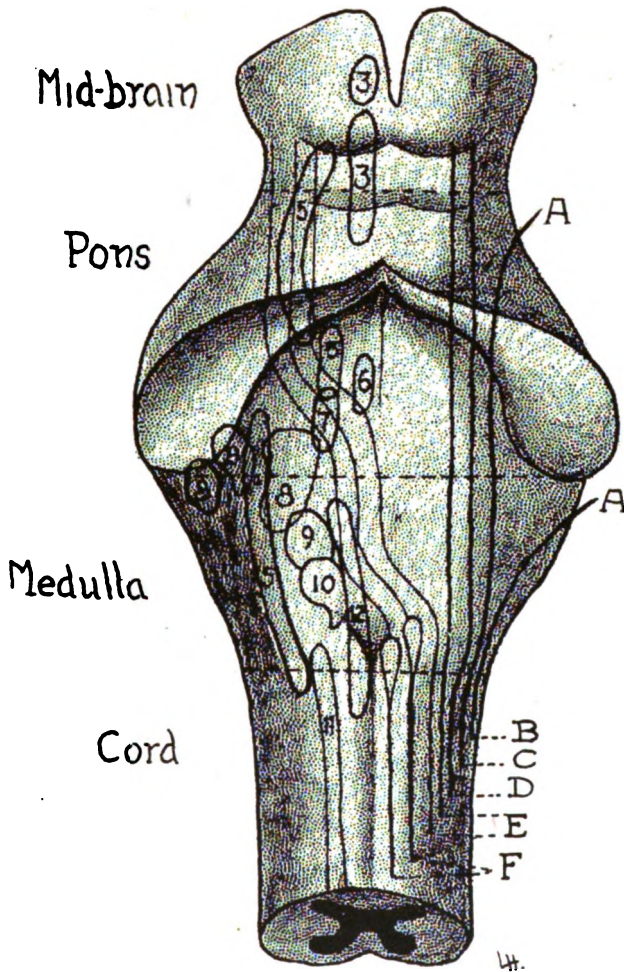


Fig. 5.—(After Dana.) Showing how lesions in the pons and medulla may cause focal symptoms by cutting off tracts and destroying cranial nerve nuclei. The motor tracts lie deep below the sensory and begin to cross in the lower medulla and cord. They are not indicated here. *A*, to cerebellum; *B*, direct cerebellar tract; *C*, spinocerebellar (Gower's tract); *D*, temperature and pain tract; *E*, tactile; *F*, muscle sense.

2. Holmes and Head: *Brain*, Lond. **34**: 1911.

of the trigeminal nerve (Fig. 4). This close association is particularly well shown by cases of occlusion of the posterior inferior cerebellar artery (Wallenberg, Breuer, Marburg and Spiller), as in this instance, where the sensory nucleus of the fifth nerve and spinothalamic tract in that region are involved. The peculiar, yet typical dissociation of sensation which this case presents is more readily understood on further analysis. The fibers for pain, temperature and touch are carried in the spinothalamic tract, which crosses to the opposite side about two or three segments above their point of entrance in the cord. The dorsal columns, which do not cross in the cord, carry the fibers for touch (in part), position, appreciation of movement, two point discrimination, vibration, size, shape, form, weight and consistence. These impulses travel together in the same columns of the spinal cord, but as soon as they reach the first synaptic junction, those impulses underlying the appreciation of posture and passive movement become separated from those concerned with spatial discrimination. (Compass test, size, shape, etc.³) This change evidently takes place at the posterior column nuclei. Before we can determine the exact paths that these finer differentiations would lead us to believe exist, a more elaborate anatomic and physiologic insight must be evolved by future study. Suffice it to say that we know that these subtle variations in the sensory mechanism do exist.

Bárány Tests.—After a careful study of the data obtained, it is difficult to reach a definite conclusion with regard to the significance of the above tests, even in the light of the recent contributions by Randall, Jones and Mills.^{4, 5} Mills and Jones have attempted to demonstrate neuraxial differentiation of the fibers from the horizontal and vertical canals. In one of their cases,⁴ in which the lesion was clearly thrombosis of the right posterior inferior cerebellar artery, the right horizontal canal failed to respond normally, whereas reactions from the right vertical canal were normal. Randall and Jones,⁵ after an examination of 129 pathologic cases reached certain definite conclusions: that on each side the fibers from the horizontal canals go to the Deiter's group, thence to the cerebellum by way of the inferior cerebellar peduncle through to the cerebellar nuclei globosus, fastigii, and emboliformis, and then to the cortex of both sides; that the fibers of the vertical canals apparently have an entirely different course, going directly to the posterior longitudinal bundle, probably entering the cerebellum through its middle peduncle; that another group of

3. Holmes and Head: Brain, Lond. **34**:124, 1911.

4. Mills, C. K., and Jones, I. H.: J. A. M. A. **67**:1298, 1916.

5. Randall, B. A., and Jones, I. H.: Am. J. M. Sc. **151**:515.

fibers undoubtedly goes to the spinal cord; that the impulses which are concerned with vertigo pass through the cerebellum.

Up to the present time there has been no confirmation of this work.

Motor Manifestations.—The motor symptoms cannot readily be grouped with the rest of the clinical picture under a single anatomic lesion. The homolateral hemitaxia being of cerebellar type, can be attributed to unilateral affection of either the spinocerebellar tracts or restiform body; but the paresis of the left face, and left arm and leg can hardly be explained on the same basis. The fact that the paresis is unilateral would point to a contralateral lesion in the cerebrum or cerebral peduncle or frontal portion of the pons in consequence of the proximity to each other of the central facial neurons and pyramidal tract in these areas. The possibility of an intracranial neoplasm must be entertained, but the absence of the more important general symptoms of cerebral neoplasm—headache, vomiting, optic neuritis and atrophy with amblyopia resulting therefrom, increased intracranial pressure, etc., mitigates against this likelihood. Inasmuch as lesions of the medulla are often diffuse and disseminated, and are especially diverse in their symptomatology, owing to the complex relations of the medulla itself, it seems most logical to seek an explanation in the form of multiple thrombi involving more than one branch of the vertebrals.

Diabetes.—The question here arises whether the diabetes is a result of the central lesion or the cause of its inception. In this respect the patient's previous history, though not very definite, associated with a family glycosuria, leads one to believe that the diabetic element is probably a priori rather than a posteriori in the sequence of the disease, and may be viewed together with sclerotic changes in the vessels as the etiologic factor in producing the thrombosis of the posterior inferior cerebellar artery.

Cardiac Phase.—Probably the most striking phase of this case is the cycle of cardiac developments that the patient manifested under observation.

On admission, bradycardia, with a rate of 68 at the apex, and a corresponding radial pulse, was present. The regularity of the rhythm was occasionally broken by extra-systoles. The next day, May 30, a telecardiogram (Fig. 6) was taken, and it showed a bradycardia with a rate of 64 and left ventricular preponderance. The P-waves were abnormally high in all three leads. The T-waves were very tall in Leads I and II, semi-inverted in Lead III. One auricular extra-systole was recorded in Lead II.

Five days later, June 5, another telecardiogram was taken, and showed the previous left ventricular preponderance plus an auricular

flutter. The auricular was 300, whereas the ventricular response was arrhythmic and varied in paroxysms between 84 and 140 (Fig. 7).

To determine whether the auricular flutter still persisted, another telecardiogram was taken two days later, June 7. The auricular rate was found to be increased to 375, but an added phenomenon was now being manifested. There were numerous cycles showing auricular fibrillation, which the electrocardiographic laboratory looked on as probably a transitory stage. The following morning, June 8, the cardiac picture was more definitely defined clinically; there was a

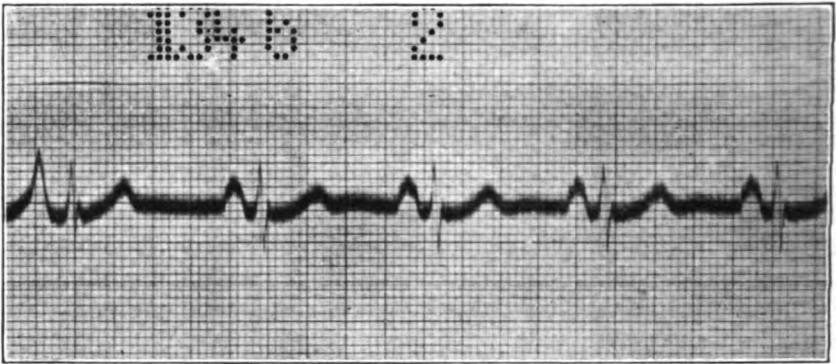


Fig. 6.—May 30, 1918, Lead II

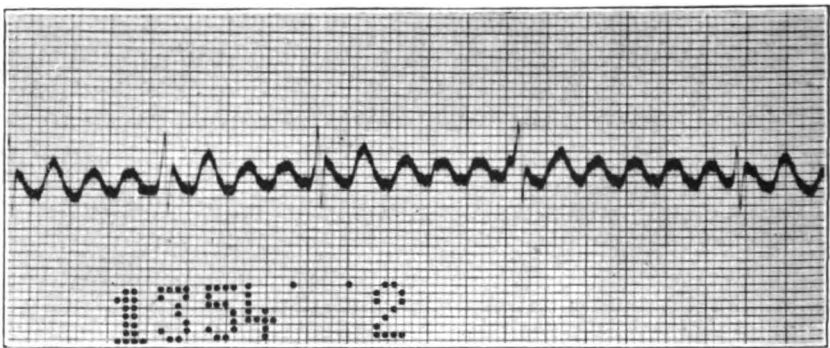


Fig. 7.—June 5, 1918, Lead II.

pulse deficit of 15, the apex beat was 108 and the radial pulse 93. The probable diagnosis of auricular flutter in the fibrillating stage was made.

On June 11, the heart was distinctly fibrillating; the pulse deficit was 10. This was confirmed four days later by a telecardiogram, which showed auricular fibrillation, and left ventricular preponderance and low voltage (Fig. 8). Under the influence of digitalis the

heart rapidly returned to normal rate and rhythm, and on June 22 the telecardiogram gave no evidence of auricular fibrillation or flutter. Several extra-systoles were recorded (Fig. 9).

These varied cardiac phases during the course of the disease present a rare opportunity to view the clinical picture from a physiologic standpoint. As well as could be determined by a careful history, the patient gave no evidence of previous cardiac disease. From the neurologic data we know that we are dealing with a lesion in the upper part of the medulla or lower part of the pons, in which the

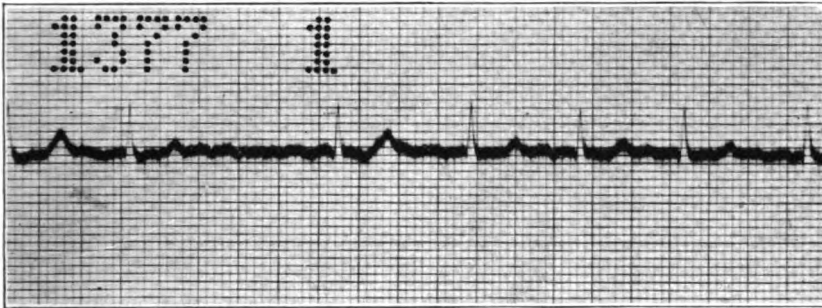


Fig. 8.—June 15, 1918, Lead I.

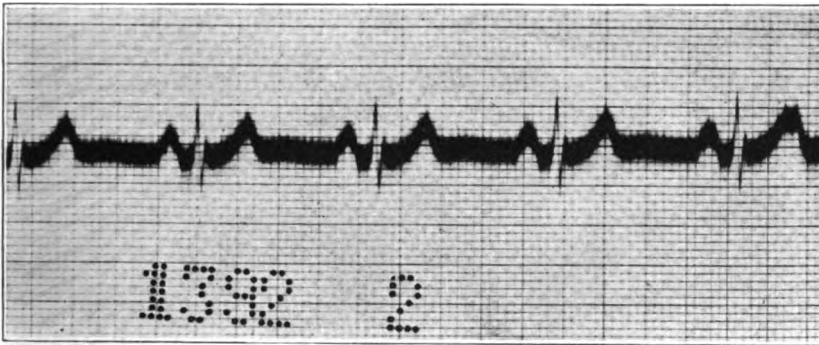


Fig. 9.—June 22, 1918, Lead II.

nucleus of the left vagus is involved. This would tend to confirm the studies that were made on the activities of the extra-cardial nerves and which have revealed marked functional differences in the right and left vagi and in the two cervical sympathetics. These differences are qualitative as well as quantitative.⁶ Thus in his experimental work on dogs, Cohen,⁷ found that stimulation of the right vagus usually caused arrest of all chambers of the heart, but appeared to have very

6. Hart: *Abnormal Myocardial Function*, 200.

7. Cohen: *J. Exper. M.* **16**:732, 1912.

slight direct influence either on conduction or on the activities of the ventricle. On the other hand, stimulation of the left vagus had only a moderate slowing effect on the auricles, but a very definite depressing influence on the rate of conduction between auricles and ventricles. His conclusions as to the differences in the distribution of the right and left vagus are shown in Figure 1. Robinson and Draper,⁸ in their studies on conduction disturbances following vagus stimulation, reached the conclusion that the left vagus has as a rule a greater influence on the property of conduction than the right vagus.

The bradycardia, which was the first cardiac manifestation, may have been due to heightened vagus tone as a result of irritation of the pneumogastric center. But the phenomenon of auricular flutter is much more difficult of interpretation. Extensive observations have shown that it rarely occurs without some other damage to the cardiac tissue. It has been suggested by some that an abnormal balance of external nervous control may be an element in the production of auricular flutter, but no anatomic lesion which would indicate a removal influence or a hypertonic activity of the accelerators has thus far been demonstrated. The evidence in our case may lead us to suspect such a condition, though we have no indubitable ground to offer for its support. The event of fibrillation presents the same problem. It has been demonstrated that while the auricles are in flutter, vagus stimulation may change the flutter into a condition of fibrillation.⁹ Morat and Petzetakis have been able to produce auricular fibrillation by stimulating the vagus and accelerator nerves. However, every heart showing fibrillation of the auricles which has been exhaustively examined, has given evidence of gross or histologic damage to its tissues, although it is a recognized fact that fibrillation of the auricles may be only temporary, as in our case. This would suggest that the cause may be of toxic or neurogenic origin. The problem is furthermore complicated by the almost immediate response which the administration of digitalis was able to call forth in our case. Pharmacologic studies have shown that digitalis acts in a two-fold manner on the functional activities of the heart. It has a direct effect on the muscle cells, and indirect influence through the vagus nerves.¹⁰ It increases the tone and irritability of the heart muscle and stimulates the vagus. If we are to presume that the various cardiac manifestations in our case are due to vagus stimulation, it is hardly likely that the digitalis produced the return to normal by its central action, for

8. Robinson and Draper: *J. Exper. M.* **15**: No. 1, 1912.

9. Hart: *Abnormal Myocardial Function*, p. 118.

10. Hatcher and Wilbert: *Pharmacology of Useful Drugs*, 1915, p. 215.

further stimulation of the pneumogastric center would have tended to aggravate the condition.

Since by the administration of atropin, vagus impulses may be cut off and thus a clinical estimate be made of the influence which it has hitherto been exerting, $\frac{1}{100}$ grain of atropin three times a day was given hypodermically over a period of nine days. It had no effect whatsoever on the heart action in force, rate or rhythm.

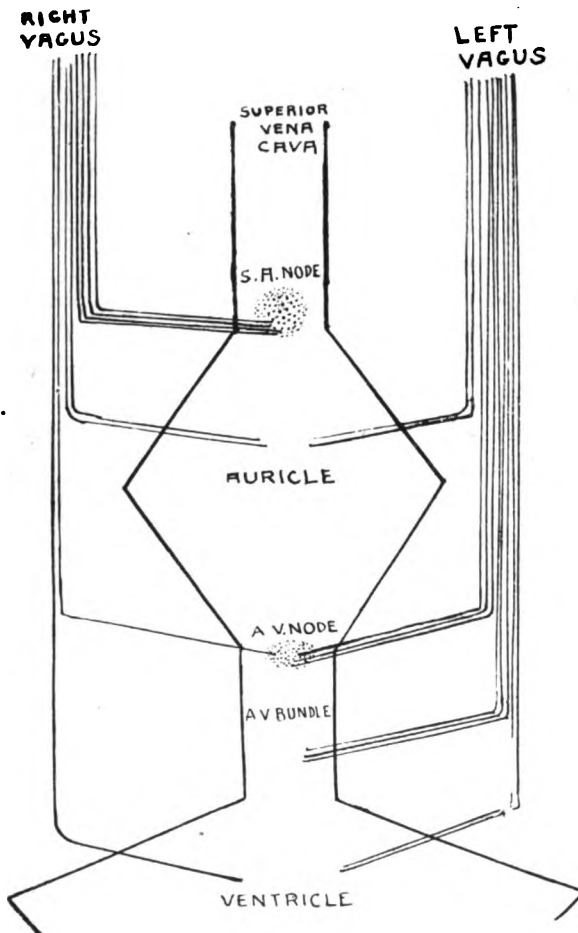


Fig. 10.—Diagram after Cohen modified by Hart indicating the distribution of the fibers of the right and left vagi and the right and left sympathetic. It is to be noted that the right vagus and the right sympathetic are, in the main, distributed to the sino-auricular node and the auricle. The left vagus and the left sympathetic have a preponderating influence over the auriculoventricular node and bundle. The data on which this diagram is based were obtained principally from the conclusions drawn from their experimental work, by Cohen, Rothberger and Winterberg.

It needs no further elaboration to indicate that the cardiac aspect of the case in the light of its neurologic background presents innumerable avenues of approach and interpretation, and tends to corroborate the physiologic experiments which have been conducted in many laboratories to explain the origin of the cardiac impulse.

SUMMARY

1. The case is one of occlusion of the left posterior inferior cerebellar artery with cardiac manifestations in a man of 48. The onset was gradual without loss of consciousness, but with a sense of giddiness, faintness and nausea, and a tendency to stagger occasionally to either side. This was followed a few days later by persistent hiccough and hoarseness.

2. In view of the presence of glycosuria and a family history pointing in the same direction, diabetes, together with arteriosclerosis, was considered the etiologic factor.

3. The symptoms resulting from this lesion embraced unilateral paralysis of the left vocal cord and the left side of the face, with anesthesia of the pharynx and absent corneal reflex in the left eye; myosis of the left pupil and narrowing of the left palpebral fissure; peculiar response to the Bárány test; and hemiataxy on the same side with alternate anesthesia of the left face and right side of the body. The sensory affection was of the dissociated type, pain and temperature sense being impaired, while tactile sensibility and muscular sense were intact.

4. In addition, the patient presented an abnormal cardiac function, which afforded ample opportunity for study with the electrocardiograph. Various irregularities were manifested; bradycardia, auricular flutter, numerous extra-systoles and auricular fibrillation. Atropin administered over a long period was unable to influence the heart action in any way. With digitalis, however, a favorable reaction was immediately obtained.

5. The symptoms in this case, besides their value from a regional diagnostic point of view, have an important bearing on the relation of the vagus center to the cardiac cycle. It is this object which prompted a record of the case in detail.

ADDENDA.—The patient left the hospital on August 28, apparently in good health, but with no change in the physical findings.

I wish to express my indebtedness and gratitude to Dr. I. Strauss for his guidance and suggestions; and to Dr. B. Sachs for permission to publish the case.

1 East One Hundredth Street.

BIBLIOGRAPHY

In addition to the references already given, the following will be found of interest:

Holmes, Gordon, and Head, Henry: *Brain*, Lond. **34**: 1911.

Robinson, G. W.: *J. A. M. A.* **61**:179, 1913.

Spiller, W. G.: *J. Nerv. & Ment. Dis.* **35**:182, 1908.

Wallenberg, A.: *Arch. f. Psychiat.* **37**:504, 1895; *Ibid.*, **34**:923, 1901.

Wilson: *Proc. Roy. M. Soc.* **2**:52, *neurol. sec.*, 1909.

Ferrier, David: *Allbutt and Rolleston System* **8**:160, 1910.

THE EYE AND AVIATION

WILLIAM H. WILMER, M.D. (WASHINGTON, D. C.)

Colonel, U. S. Army

MINEOLA, L. I., N. Y.

Samuel Johnson (1759), in his "Rasselas, Prince of Abyssinia," sets forth very graphically the principles of flying. He says:

He that can swim needs not despair to fly; to swim is to fly in a grosser fluid, and to fly is to swim in a subtler. We have only to proportion our power of resistance to the different density of matter through which we are to pass. You will be upborne by the air if you can renew any impulse upon it faster than it can recede.

Professor Pike calls attention to the similarity of the labile equilibrium of the flier and of the fish. He notes the fact that in free-swimming forms, the semicircular canals are well developed; but until the otic labyrinth of the birdman has become more highly developed by change of environment, the eyes must be considered one of the most important of the peripheral sense organs concerned in the very complex problem of equilibrium. Increasing experience with the human machine in aeronautics impresses one very deeply with the feeling that from the beginning the instructions of the chief surgeon to the examining units have been very wise in insisting on good vision, sound eyes, normal muscle balance and strength, stereoscopic vision and ability to recognize colors. In the further classification of pilots, it is also very necessary to test the subjects in regard to their retinal sensitivity.

GOOD SIGHT AN ESSENTIAL REQUISITE IN AVIATION

The value of *acute sight* is so apparent that it seems hardly necessary to draw attention to it as an essential requisite in flying. But no other nation insists on the high standard held by the air service of the United States. It is important in distinguishing enemy planes from those of our allies, in making good landings, and in observing objects of military importance within and beyond the enemy lines. The pilot who sees the enemy first has an enormous advantage in being able to make the first maneuver. Where two planes are approaching each other at the rate of nearly 150 miles an hour (for each plane) one can readily appreciate the importance of good sight. In the tests at the laboratory we have not been able to verify the statements of French observers that the vision of the aviator at about 200 meters increases

practically one-third owing to the congestion of the head in general and of the retina and choroid in particular.

We have found in errors of refraction, in which the focus is preserved by a muscular effort, that there is a falling off in visual acuity during oxygen want, such as one would meet in the air. This is particularly true of hyperopia, in which the accommodation weakens. It is conceivable, however, that increased visual acuity might possibly occur under three conditions:

1. In Europe, where a certain amount of myopia is allowed, there could be an increase of sight in the air owing to a relaxation of the muscle of accommodation.

2. In mild degrees of toxic amblyopia, such as is produced by tobacco, there is a certain amount of anemia of the optic nerve. In these cases, there might be during a flight an increase of visual acuity from the congestion of the intra-ocular tissues.

3. Objects in a rarefied atmosphere are more clearly visible, and vision is improved for a while by the concentration that ensues from the sense of isolation in flying.

In point of fact, the question of change in visual acuity during oxygen deficiency has been under investigation at the laboratory for some months, yet the subjects examined have not been sufficiently numerous to make a statement on the matter authoritative. However, all records up to the present date show that vision has improved in 16.6 per cent., has become worse in 33.3 per cent., and has remained stationary in 50 per cent. The greatest care has been taken to make the tests of vision as accurate as possible by using not only the ordinary Snellen's type, but the Ives visual acuity apparatus, and the instrument devised by Lieutenant Johnson. In spite of all care, however, the elements of practice, memory, fatigue, etc., contribute largely to the possible sources of error.

GOOD MUSCLE TONE NECESSARY

Of almost as much importance as good sight is *good muscle balance and strength*. Otherwise there is a progressive loss of muscle tone as the pilot ascends, resulting in a restricted field of binocular fixation, double vision, and loss of accommodation. Under such conditions there would be difficulty in perceiving and placing an enemy machine and in seeing accurately the barograph, air speed indicator, revolution counter, compass, inclinometer, drift-meter and the numerous other instruments under the eye during flight.

Some time ago I examined the eyes of a pilot who had suffered from two crashes, each accident having been caused by his reading the barograph incorrectly. The last time, he read the instrument as

showing that he was 1,800 feet above the ground, when in fact he was only 150 feet. In this case, the difficulty was loss of accommodation owing largely to a hyperopia of 1.75 degrees.

In our practical experience, exophoria and hyperphoria are much more serious than esophoria. It has been found that in about 7.37 per cent. of subjects whose muscle strength is normal, there is a decrease in the field of fixation, while this decrease in the field of fixation occurs in 50 per cent. when the muscle strength is subnormal. In these cases, the decrease in the field is more marked in the upper than in the lateral or in the lower portions. In general, one may say that there is a progressive falling off in the muscle strength as the artificial altitude increases.

OTHER VISUAL FACTORS THAT ARE IMPORTANT

The power of *stereoscopic vision* is not considered necessary by enemy nations, and even allied nations do not consider it requisite because its requirement is too stringent. However, its possession is a great asset. This, added to good vision and muscle strength, aids greatly in judging distances, and therefore in making a good landing. For it is harder to make good landings than to do seemingly very difficult stunts in the air. Crashes due to faulty landings are most numerous. In landing, it has been pointed out by Dr. Anderson that the pilot misjudges his distance from the ground and either flattens out too soon and "pancakes," or flattens out too late and strikes the ground at a great angle, usually overturning and wrecking the machine. So far there is no definite falling off in the function of stereoscopic vision during reduced oxygen tension until just before a general break comes.

Good color vision is essential for the pilot in order that he may readily differentiate the markings of planes and distinguish between those of the enemy and those of friends. In landing at night, it is essential to distinguish the signal lights at the airdromes and to locate thereby his own field and hangar. So far our tests do not show any decided change in color vision during decreased oxygen tension.

On account of the very nature and design of the plane, the *visual field* of the airman is contracted irregularly. There is a central portion cut out below and the field is further limited by the wings and interfered with by the wires, struts, etc. However, it is of importance that the remaining field should be acute for catching the motion of an object, an oncoming plane, or landmarks in landing. The art of picking up objects with the peripheral retina, which is probably well developed in the lower animals, is increased in the airman by practice. The famous French "ace," Nungesser, says: "You need eyes all around your head, and after a time you get them."

While our tests of the fields are not based on large enough numbers to be conclusive, in general, we have found a tendency toward enlargement of the fields for white and colors up to 5,000 feet; and from 5,000 to 15,000 feet the fields have remained fairly constant, while at 20,000 feet there is a general constriction of the visual fields in which green suffers the most contraction.

Normal *retinal sensitivity* is important for aviators of all types, but it is a *sine qua non* for those who fly at night. Retinal sensitivity may be tested in two ways:

1. **Threshold Sensitivity:** By determining the least light stimulus the retina is conscious of by increasing the intensity of the stimulus until the eye is conscious of its existence. This method requires the complete adaptation of the eye by remaining in the dark for at least fifteen minutes. This requires too much time and care.

2. **Contrast Sensitivity:** The light being constant the subject is tested by seeing the minimum contrast that the retina is capable of recognizing. For practical purposes, the test object is a gray letter on a light gray background, there being thirteen shades of perceptible difference between them. Then one eye is closed and the photometric wedge is passed before the other eye until the letter blends into the background and can no longer be recognized. The point is noted on the millimeter scale of the wedge where this occurs. This is repeated three times for each eye. This wedge, which was devised by Lieutenant Reeves, consists of a layer of gelatin of increasing density of color between two pieces of optical glass. The light transmission has been calculated for each millimeter on the scale and the normal has been established by repeated tests at the laboratory.

PROTECTION OF THE EYES

The question of protection of the eyes of the pilot from wind and bright light is a most important one. The protective goggles should be of good optical glass, free from irregularities, and should afford high transmission. Their contour should permit the widest field of vision possible. The metal portion of the frame should be so constructed that there would be no danger of its being driven forcibly into the eye or face. Nearly all accidents to the eyes and head occur through the head being forcibly thrown against the *fuselage* in making *a bad landing*. Colorless lenses may be worn simply as a protection against the wind. However, the glare encountered in flying above clouds or over sand, snow or water is not only blinding to the vision, but is exhausting to the nervous apparatus by overstimulation of the retina. In the morning, when flying against the enemy, our pilots have to fly with the sun directly in their eyes. In flying away from

the sun, when it is near the horizon, I personally have found that there is a very fatiguing shimmering reflection from the rapidly moving propeller blades. Under these conditions a tinted glass gives a great sense of relief. The best tint for this purpose is a glass with a greenish yellow tint. While giving a high transmission of those spectral rays which are most useful for acute vision, this tint cuts out the harmful short rays and does not change the color of red, greens or blues. It not only protects the sensitive nervous expansion (the retina) from the irritating actinic rays, but it is restful by preventing the necessity of the muscular apparatus of the eye having to adjust the lens to the shorter wave lengths. In addition, this tint actually increases the visual acuity in dust, smoke, mist and fog, by preventing the diffraction and dispersion of light rays by the small particles that produce these atmospheric conditions. It acts as a ray filter, and helps in the detection of camouflage, especially the form produced by paint.

It seems necessary to lay a little stress on the matter of this tint because many rather vague suggestions as to the best tint have been put forward by some observers. It has even been noted that neutral tinted glasses have been suggested because they dim the entire visible spectrum. No airman, however, will wear goggles that materially diminish vision centrally or limit it laterally. An English flier tersely remarked concerning an official goggle: "These are sudden death overseas. You cannot see out of the sides."

The delicate mechanism of the eye indicates as surely as the other organs do the falling off in function during the nervous and physical fatigue of flying and fighting in an atmosphere of diminished oxygen tension, and points to the necessity of proper physical training and expert medical care to prevent the otherwise inevitable staleness of the aviator.

COMMENT

The sense of dizziness and insecurity that one feels on the top of a high building or by rushing water does not exist in the air. Beneath, the earth lies serene and like a beautiful map. The cultivated fields are like bits of brown velvet, and the trees stand out like the Noah's Ark trees of our childhood. It is true that the earth does rush toward one in a nose dive, that it drifts away in a rapid ascent, and that it playfully tilts up in banking, but one's isolation lends a feeling of stability and security. Were it possible to eliminate the whirl of the motor, one would experience the feeling of a "peace that passeth understanding."

For their interest and ability in attacking the many necessary problems and in making careful tabulations of results, I desire to express my obligation to, and my appreciation of Captain Berens (the head of the Ophthalmological Department of the Medical Research Laboratory) and his able co-workers.

THE EAR AND AVIATION

EUGENE R. LEWIS, M.D. (DUBUQUE, IOWA)

Lieutenant-Colonel, M. C., U. S. Army

MINEOLA, L. I., N. Y.

In undertaking to train a man to learn to fly, the Army demands that he be a normal man in good health. Therefore, each applicant for this training is given a careful complete physical examination, including the special senses. The ear examination includes tests of sound-perception, and of the motion-perception of the vestibular apparatus; the regulation requirements demand normal acuity of perception.

The difference between the man on the ground and the man in the air lies in the fact that the former can stand still, the latter cannot. When the flier walks across the field to his plane, all his motor coordinations are concerned with maintaining the proper relation between his body and the element which is supporting its weight — the earth. When he straps himself in the seat before flight, he practically straps wings to his body, thenceforth, until the end of his flight, every motor coordination is concerned with maintaining a proper relation with the new element which is supporting his weight — the air. The only means he possesses of adjusting his relation with the new weight-supporting element is the plane; while flying, all motor coordinations, whether carefully calculated or instinctively performed, are concerned exclusively with controlling the plane. The promptness and efficiency with which motor coordinations are performed depend directly on the acuteness of sensory perceptions.

Rising in the air in an aeroplane is made possible only by rapid motion. Acuity of motion-perception assumes much greater importance to the flier than to the pedestrian, and in order to appreciate the full importance of this, one must have a clear conception of the component senses going to make up motion-perception. Muscle-and-joint sense, splanchnic or visceral sense, kinesthetic sense — all grouped for convenience under the term "deep sensibility," vestibular sense, vision and tactile sense each participate in the composite of general motion-perception.

THE IMPORTANCE OF MOTION-PERCEPTION TO THE AVIATOR

Deep sensibility, on the ground, is practically exclusively concerned with sensing the effect of the pull of gravity on the body; in the air it is also concerned with sensing the effect on the body of two other pulls, that of the plane's propeller, and that of centrifugal force on

curves. Impulses generated by these three pulls coming in via the deep sensibility tract must undergo accurate analysis in the brain and be properly estimated and labeled if confusion and misinterpretation are to be avoided in the sensorium. While such analysis is accomplished by normal individuals, it is only at the exclusion of a certain amount of the more accurate sensing of the pull of gravity. Whereas, on the ground practically 100 per cent. of this incoming information expresses gravity pull, a less percentage of gravity pull is expressed by it in the air.

Vision, possibly the most important of all motion-perceiving senses on the ground, suffers some impairment of its usefulness in the air by reason of the reduction in the number of visible elements in the new environment such as the usual objects making up the landscape. When darkness or cloud further reduces the utility of vision, this sense becomes almost eliminated as a source of guiding information to the flier.

Tactile sense contributes less than any of the other three senses to motion-perception on the ground; to the flier, although insulated by warm clothing and helmet, it is still of value as a source of guiding information.

Vestibular sense suffers no depreciation in utility in the air as compared with on the ground. Its sole function has always been, and continues unaltered in any way to be, pure sensing of motion. In flying, therefore, its function assumes a relatively greater importance than that of the other special senses cooperating with it to furnish the individual with his composite of knowledge concerning motion.

VESTIBULAR TESTS

The motion-perceiving apparatus of the internal ear is subjected to *stimulation* by motion of certain standard quantity and quality, and the results are observed according to uniform standard methods. Two results are noted—a *sensory result*, the subjective sensation of motion, and a *motor result*, involuntary movement of the eyes. When the subjective sensation of motion is in accord with fact, we call it normal sensing of motion; when it is not in accord with fact, we call it "vertigo." The only difference between normal motion-perception and *vertigo* lies in the sensing of motion being in accord with, or contrary to fact. The most practical means of applying motion stimulus is by the rotating chair, since the application of motion in a linear direction, for the period of time and in the intensity necessary to elicit certain standard responses to that stimulus would necessitate apparatus entirely too bulky to be susceptible of practical application under ordinary conditions of office examination. By making use of a rotational motion stimulus instead of a linear motion stimulus, it was

possible to work out a standard means of applying motion stimulus in certain definite quality and quantity in a manner, and by means of an apparatus easily handled in an office. For this reason only, the subject of the tests of the vestibular apparatus is made to experience rotational vertigo. An additional advantage in using the rotating chair is that it applies motion stimulus of a character to produce a more enduring stimulation of the end organs of the semicircular canals.

Motion in a linear direction applied to a fluid contained in a closed semicircular canal is physically incapable of setting up an enduring flow of that fluid, just as rotational motion applied to a fluid contained in a straight canal cannot set up an enduring flow.

NYSTAGMUS PRODUCED BY MOTION STIMULATION

Ewald's experiment long ago determined that involuntary pulling of the eyes in a certain definite direction and plane occurs during the time the fluid in a normal semicircular canal is made to flow in one direction; and that during the time this fluid is made to flow in the opposite direction involuntary pulling of the eyes in the opposite direction occurs. By applying rotational motion, it is possible to reproduce Ewald's experiment in effect, as a test of eye-reactions to vestibular stimulation; and when the character and intensity of rotational stimulus is standardized, comparisons of the results can be made and a normal eye-reaction determined. This motor expression of motion stimulation is nystagmus.

MEASURING VERTIGO

The normal man experiences a sensation of vertigo for between fifteen and thirty seconds after being turned according to standard technic. Evidence of this subjective sensation may be had by *voluntary* or *involuntary testimony*; *voluntary testimony*, such as "I'm turning to the right," "I'm still turning to the right," etc., during the persistence of the subjective sensation; *involuntary testimony*, such as pointing test and falling. Standard tests make use of involuntary testimony in all cases; occasionally this is amplified by voluntary testimony with advantage. In observing the pointing before turning a very important element in the test can be injected by implanting in the mind of the applicant the definite idea that he is to attempt to determine the location in space of the observer's finger solely by registering in his memory the location of it according to his tactile sense. This can be augmented by having him touch the observer's finger in more than one position (*pointing test*); as, for instance, directly in front of the right hand, come back and touch; then locate again 30 degrees outward and come back and touch; the same procedure in front of the left hand. This implants in his mind the fundamental idea of

being able to orientate himself solely by means of afferent impulses from his tactile end-organs. After standard rotation to the right, for example, normal man experiences certain very definite vertigo, a subjective sensation of turning to the left in the same plane as the rotation for a normal period of time. If the pointing test is carried out during this period of vertigo, instead of succeeding in pointing accurately to the testing finger he executes the pointing in accordance with his subjective sensation of motion. Feeling that he is turning definitely away from the testing finger to the left, he reaches for it to the right. This is normal past-pointing.

METHOD OF APPLYING THE PAST-POINTING TEST

The insulation of the applicant during this test should be as perfect as possible. A black domino mask should be used, absolute quiet should be maintained, olfactory impressions should be shunted out, and he should be left as solely as possible dependent on the information brought to him along the *vestibular tract alone*. The applicant should be definitely instructed before turning that he should not expect a verbal order to touch the observer's finger, raise his hand and come back, and attempt to find it after the turning; he should be practiced before turning in executing his touch, raising the hand, and coming back to find the finger on receipt of the signal from the observer's finger as it comes into the position which it maintains during the test—the observer bringing up his finger into position so as to tap the applicant's finger as a signal for him to execute his pointing without verbal command. It is very important for the applicant's finger to find a finger of the observer when he comes down in search of the finger which is testing him. Otherwise, there is injected into his mind a disconcerting element of dissatisfaction in having failed to find the finger for which he was searching. For this purpose the index finger of the observer's left hand can be held in readiness to furnish the touch necessary to shunt out this sense of failure. In observing the past-pointing after rotation the observer's right index finger should be definitely fixed against the observer's hip, so that visual attention to it on the part of the observer can be dispensed with, the hip rest insuring its remaining definitely where it was when the applicant first touched it in making the pointing test. The observer's eyes can then be free to watch the applicant's finger at the top of the swing. Past-pointing at the top of the swing is just as definitely normal past-pointing as at the completion of return to touch. Many cases compensate after evincing a normal tendency, let us say, to past-point outward with the right hand when they should do so, and subsequently execute a compensatory touch or inward-pointing at the bot-

tom of the return. In such cases the pointing should be registered as that executed at the top of the swing, which is the primary and clean response before it has been altered by the subconscious or conscious compensation effected by other mental processes. Visual attention on the part of the observer to the applicant's hand at the beginning of his downward pointing is of enormous importance, and it should be very carefully observed as part of the standard technic.

APPLICATION OF THE FALL TEST

The fall test is similar. A normal man, on attempting to sit upright after leaning forward during right rotation, feels that he is turning to the left, for instance, and so gives involuntary expression to this sensation by falling to the right on attempting to assume an erect sitting posture.

These tests can be completed in less than four minutes. The neurologist will especially appreciate the extent to which the central nervous system has been examined, and determined to be normal during these tests of the vestibular apparatus.

COMMENT

In view of the foregoing, it is apparent that in flying, motion takes on a much greater importance as regards potential safety or disaster for the individual than it possesses on the ground, and that motion-perception is commensurately of greater importance in the air than on the ground.

Regardless of the actual percentages which would express the shares of vision, deep-sensibility, and vestibular and tactile sense in the total of motion-sensing on the ground, it is established that three of these four are reduced in efficiency by conditions incidental to flying, and the fourth, vestibular sense, is not so reduced, and is therefore of relatively increased importance. It follows that it is of prime importance to determine that men to be trained as fliers possess normal vestibular apparatus. So important is it for the flier to possess normal vestibular acuity of motion-perception that no man should be permitted to begin training as a pilot who has not definitely shown normal reactions to vestibular tests.

This, however, does not end the otologist's responsibility in aviation. It must be borne in mind that physical deteriorations of the vestibular apparatus are always possibilities. Cases have been encountered in which men have gone into the service possessed of normal vestibular sense, and subsequently developed marked impairment of their vestibular function, seriously reducing their flying ability. Re-examination of all fliers at intervals is just as necessary to proper maintenance of the flying service as is the first examination of applicants for admission to this service.

ON THE FOCALITY OF MICROSCOPIC BRAIN LESIONS FOUND IN DEMENTIA PRAECOX

E. E. SOUTHWARD, M.D.

Pathologist, Massachusetts Commission on Mental Diseases; Director, Psychopathic Hospital, and Bullard Professor of Neuropathology,
Harvard Medical School

BOSTON

THE IDEA OF MICROLOCALIZATION

A number of investigators of the mind and its diseases are now pursuing the study of the nervous system along lines roughly summed up in the term microlocalization. But this task must not be conceived narrowly as a task of the histoneurologist or the histoneuropathologist. Microlocalization in the nervous system and especially in the cerebral cortex has threads running to the broadest issues of physiology, embryology and psychology. Yet no one feels that psychologists, embryologists, physiologists, anatomists or even pathologists, in the narrower sense of the term, will solve the problems of microlocalization or even demarcate its problems for solution. When the idea of Flourens that the brain parts were mutually exchangeable in function like so many liver parts, was replaced with the ideas of topographic differentiation which we attach to the work of Hughlings Jackson and of Hitzig, it was as if the naked eye of observation was replaced with a lens of considerable power. The situation now is that this lens of great power, provided by the work of the embryologists, the physiologists and the clinical anatomists, must be replaced with a lens of still greater power, one that will permit us logically to face problems of microlocalization attaching to physiologic complications within the single gyrus. It has become a commonplace that the brain is a congeries of organs. It is not so well understood that each gyrus is a wonderland of structures and functions in which rich results are to be expected from hard but fascinating research.

As we look over the history of these developments, we of course find that Bevan Lewis had, in advance of his time, laid down the idea of cell differentiation within the cerebral cortex, clearly distinguishing the large cells of the motor cortex, for example. In much of the work of Meynert and Flechsig, the idea of microlocalization can be discerned. However, even in the embryological considerations of Flech-

sig, the notion of the gyrus as little more than a functional unit is the prevailing idea. Decades were devoted to the isolation of one neuron after another by ingenious technical methods and to developing the conception of the nervous system as a mass of embryologically and functionally separate units, expressed, for example, in the neuron hypothesis of 1891. Listeners to the lectures of Nissl became familiar with his ideas of the structural and functional differentiation of the various cortical parts.

The idea of microlocalization scarcely flourished to the full in the last decade of the nineteenth century, however, since workers were engaged in assimilating the principles of Weigert concerning neuroglia and in trying to find qualitatively the same sort of lesions in the nervous system that they were finding in other organs. In fact, this search neatly culminated in the establishment in the years 1899-1904 of general paresis as a definite example of chronic inflammation of the nervous system. The pathologist was here trying to find, and succeeded in finding, certain lesions scattered in different parts of the nervous system, and lesions of qualitatively the same sort throughout. Nor, in the rush of new ideas, was the material in general paresis used to the utmost in throwing such light as it might on the problem of microlocalization. Thus, had the world been seriously trying to find out the nature and genesis of mental phenomena and symptoms, it would surely have executed elaborate studies in the distribution of the characteristic paretic exudate, with the idea of correlating these local variations in exudate with processes and symptoms. The issue of such an investigation could have been only positive or negative. As it stands, the situation is doubtful. In fact, it may be confidently doubted whether the paretic exudate itself is at all responsible for many of the characteristic symptoms in paresis, for example, grandiosity, amnesia or even dementia, symptoms which are not found to correspond even roughly with the amounts of exudate discovered in the brains.¹ So far as paresis is concerned, very possibly it was more important to determine it to be syphilitic and to embrace eagerly the opportunities afforded of a Wassermann reaction than to pursue seemingly recondite studies in microlocalization. Meantime the topographic anatomists were laying down the results which the pathologist could at last employ without signal loss of time.

When the interesting and fundamental work of Hammarberg appeared on the histology of freeblemindedness in 1895, it was plain

1. Southard, E. E.: A Comparison of the Mental Symptoms Found in Cases of General Paresis With and Without Coarse Brain Atrophy, *J. Nerv. & Ment. Dis.* 43:204, 1916.

that this Swedish investigator had had to spend more than half his time, not on the histopathology of feeble-mindedness, but on normal histology. The situation is now greatly improved with the work of Elliot Smith, who showed that even the naked eye will, under proper conditions, detect striking differences between the gyri of different parts of the brain on section, and especially with the work of Campbell, who, after an extensive study of the histology of the different gyri, has offered a valuable atlas with a store of functional comments and speculations.

Even before Campbell, Bolton had laid down exact lines concerning the histology of different parts of the occipital region, and had contributed the idea of visuo-sensory and visuo-psychic regions therein. Similar work has been done by Brodmann, in Germany, who however feels that functional speculations are hardly in point at the present time. Visitors in the private laboratory of Vogt in Berlin some years since must have been impressed with the tremendous elaboration of structures which could be demonstrated in the different parts of the brain, even by so simple a technical method as the method of Weigert for myelin sheaths. For decades, also, the world has been watching the development of the ideas of Ramon y Cajal, whose labors stand not second to those of Bolton, Campbell, Brodmann, and the rest of the topographers.

In fact, the research situation is theoretically so promising in view of the progress along all these lines by workers in different countries, that it is a little surprising that so little neuropathologic application has been made of the results as attained. There seems to be a curious lack of tempo in neuropathologic research. Bevan Lewis' ideas of cortex differentiation came, it would seem, too early to affect the main current of investigation. The work of Donaldson in 1889-1890 on the brain of Laura Bridgman has not been followed up by any considerable series of similar investigations, and the Laura Bridgman work apparently led its author to deeper considerations of growth and development rather than to progress along the line of neuropathology.

ANTILOCALIZING VIEWS OF PSYCHOLOGISTS

Again, late in the nineteenth century, there prevailed the Wundtian psychology. The reader of Wundt's analysis of aphasia, for example, is convinced that, despite the profound distinctions made, the philosopher was no longer a physiologist and set himself the task of anti-localization in the spirit of a system-maker rather than that of an independent seeker after facts and independent interpretations. The idea of the unity of the mind, a very fine-grained and closely interwoven unity, has prevailed in many quarters, perhaps in all quarters, dominating research. To these psychic unitarians it would

have seemed almost a pity if any one could show, for example, an identity of speech processes with processes of the left inferior frontal gyrus. To the conservative wing of the psychic unitarians was added the force of those strictly scientific persons who feel that a fact is a fact and a speculation is necessarily a bad speculation. Thus, for example, if the simpler ideas of Broca concerning speech localization ought to be modified by the modern concepts of Marie, then this is scored as a victory by those holding to the adamantine unity of the mind, on the one hand, and by those who are sceptical of all scientific results in the psychic field of whatever sort.

Added to this situation was the Freudian tendency. Disregarding the truth or falsity of the Freudian contentions, it is clear that his followers are engaged much more in finding satisfactory categories of a logical nature in which to place global tendencies shown by their patients than they are in conceiving the brain functional lines along which an hysterical dissociation might proceed, a repression be mechanized, or a censor be enthroned.

Inasmuch as Descartes made a laughable error in assigning the seat of the soul to the pineal body, it is best for the modern to "play safe" by failing to notice both the pineal body and the brain itself and to solve the problem either by denying that it exists or by failing to consider it at all. One of these modern worthies assured me some years ago that there was no doubt a correlation between mental processes and brain processes and that, theoretically, the "needle" of demonstrable lesions could be found in the "haystack" of neuronic brain systems, but that for his part he regarded that problem as theoretically solved and desired to get on with something genuine and practical.

Accordingly, the academic psychologists, if we may so term the Wundtians, and the apparently more radical Freudians, have alike little interest in the matter of microlocalization, that is, in the correlation of mental with brain processes, either normal or pathologic.

It is, therefore, almost with a feeling of being alone in the wilderness that one endeavors to work in the direction of neuropathologic correlation; either there is no problem or it is theoretically settled beforehand. A psychiatrist of light and leading asked me one day what, after all, I was about in working along structural neuropathologic lines. Anybody with a logical turn of mind and any capacity for observation ought rather to be busily applying the modern categories of psychopathology to clinical psychiatric and neurologic material. If such doubt of the fundamental value of this kind of work could prevail in the mind of a leading psychiatrist, I felt that I could do no better than bring these general ideas before the Association of American Physicians.

It is, as possibly throwing light on the problems of microlocalization, that the material in dementia praecox struck me as of value. To be sure, the world was full of a rather empty discussion as to whether dementia praecox was an organic or structural disease. Any one who professes to find brain changes in dementia praecox was perforce regarded as a controversialist, engaged in demolishing the pet ideas of some workers who wanted to show that dementia praecox was a disease of maladaptation or a disease with so-called Freudian mechanisms. Let me say, therefore, that to embark on studies of the brain in dementia praecox and to find brain changes therein is not at all to deny that dementia praecox is an instance of maladaptation of the individual to his environment and not at all to deny the possible importance of Freudian mechanisms in the disease.²

ANOMALIES IN DEMENTIA PRAECOX BRAINS .

In 1906, I began to study the brain problems of dementia praecox and collected first-fruits of that study at the Medical Congresses in 1910³ and 1913.⁴ I then showed that the brains of dementia praecox subjects were extremely likely to show evidences of anomaly, that even when there was no anomaly, there were very likely to be microscopic changes. To be specific, I found twenty-three out of twenty-five carefully studied brains to be significantly anomalous. I do not mean that the anomalies shown were visible the whole length of the demonstration hall, as they are apt to be in brains of the feeble-minded; but I mean that the asymmetries and irregularities were of a demonstrable and photographable nature. Friendly critics offered the suggestion that similar anomalies were to be found in brains of normal persons. Unluckily, the brains of normal persons, in large numbers, are not available so far as I know in any laboratory in the world, at least in such a state as to permit proper photographic analysis. However, I think I am able to answer these critics by showing that the brains of subjects of the so-called manic-depressive psychosis show such anomalies in very few instances.⁵ Using certain criteria, I found four fifths of my dementia praecox brains to show such anomalies and but one fifth of the manic-depressive brains similarly affected.

2. Southard, E. E.: The Mind Twist and Brain Spot Hypotheses in Psychopathology and Neuropathology, *Psychol. Bull.* **11**:117, 1914.

3. Southard, E. E.: A Study of the Dementia Praecox Group in the Light of Certain Cases Showing Anomalies or Scleroses in Particular Brain-regions, *Proc. Am. Medico-Psychol. Assn.*, May, 1910.

4. Southard, E. E.: On the Topographical Distribution of Cortex Lesions and Anomalies in Dementia Praecox, with Some Account of their Functional Significance, *Am. J. Insan.*, October, 1914, and January, 1915.

5. Southard, E. E.: Anatomical Findings in the Brains of Manic-Depressive Subjects, *Boston Med. and Surg. Jour.*, 1915, **172**: No. 4.

But it is one thing for a brain to be anomalous and another for it to be functionally disordered. The underlying hypothesis here is that the anomalous regions of the brain are in some sense weak places therein, such that disease of a toxic or metabolic nature, for example, at puberty, may unfavorably affect the anomalous and poorly constructed region. These considerations I presented with some histologic confirmation at the 1914 meeting of the Association in a paper "On the Direction of Research As to the Analysis of Cortical Stigmata and Focal Lesions in Certain Psychoses."⁶ Further reflection on this finding led me to the considerations about tissue decomplication developed at the 1915 meeting.⁷

But it was clear that the few cases of normal-looking brains in dementia praecox formed the crux of the situation, since the critics of material from anomalous brains might properly charge the investigator with inability to cull out the acquired from the inborn lesions. I therefore determined to study with sufficient intensiveness the brains of cases of dementia praecox that showed no anomalies or scleroses. In connection with this study, five brains were investigated, four of them looking in the general direction of dementia praecox and one of them in that of manic-depressive psychosis. These five brains were the residuum of a series of 120 coming from psychoses of all sorts.

Before I could bring the topographic problem into clear relief, I found that in the analysis of these five brains, the problem of parenchymatous versus interstitial lesions stood out. At the 1916 meeting I presented the conception that in the nervous system there should be a dissociation of lesions somewhat similar to that in the kidney.⁸ To be sure, the parenchymatous and interstitial lesions of the kidney are, as is well known, often if not almost always commingled. But the fact that the lesions in these two types of renal tissue are so commingled in a given case militates not at all against the idea that there are, roughly speaking, two kinds of nephritis—parenchymatous and interstitial. The same theoretical situation holds in the nervous system. I found that parenchymatous and interstitial lesions could be dissociated and combined in the nervous system, much as similar lesions could be dissociated and combined in the kidney. To be sure,

6. Southard, E. E.: On the Direction of Research as to the Analysis of Cortical Stigmata and Focal Lesions in Certain Psychoses, *Tr. Assn. Am. Phys.* **29**: 1914.

7. Southard, E. E.: Advantages of a Pathological Classification of Nerve Cells, with Remarks on Tissue Decomplication as Shown in the Central and Cerebellar Cortex, *Tr. Assn. Am. Phys.* **30**: 1915.

8. Southard, E. E.: On the Dissociation of Parenchymatous (Neuronic) and Interstitial (Neuroglia) Changes in the Brains of Certain Psychopathic Subjects, Especially in Dementia Praecox, *Tr. Assn. Am. Phys.* **31**: 1916.

the parenchyma of the nervous system was a parenchyma composed of neurons and their adnexa and the interstitial tissue of the nervous system was complicated by the fact that a great deal of it is neuroglia tissue, embryologically different from the interstitial tissue of the kidney. Nevertheless, it is well known that many of the properties of neuroglia of ectodermic origin are similar to the properties of mesodermic interstitial tissue. The alterations of the mesodermic interstitial tissue also existent in the nervous system are of far less consequence than those of the neuroglia tissue. The one case of manic-depressive psychosis, intensively examined, failed to show convincing degrees of parenchymatous lesion, but the dementia praecox case had well-marked parenchymatous disorder, that is, varying degrees of cell loss, to which the interstitial reaction, that is, gliosis, was found to be not at all proportionate. The result of this study seemed to be that parenchymatous disorder, namely, cell losses and interstitial disorder, namely, gliosis, must be investigated separately if we are to make headway in this group of cases. Thus it would be decidedly unwise to argue from the data of neuroglia preparations that the gliosis of such and such an area was an indicator of parenchymatous loss. To be sure, the gliosis is probably an indicator of something of general or local significance in the brain. But no facile application of the principle suggested by Weigert's neuroglia work could safely be made. Even if gliosis, as a rule, signifies some degree of wear and tear on the part of the parenchyma of the part affected, yet there was no good evidence that the gliosis was at all proportionate to the parenchymatous wear and tear.

STRATIGRAPHICAL ANALYSIS OF THE CEREBRAL CORTEX

Having thus shown that the brain conditions roughly corresponded to, for example, renal conditions, and that the histopathologic analysis of injured brain tissues must look in both these directions in search of successful correlations, I proceeded to a stratigraphical analysis of the finer cortex changes in these brains, presenting results at a meeting of the American Neurological Association.⁹ I tried to study separately the nerve cell losses, on the one hand, and the gliosis (including satellitosis), on the other hand, and then to learn whether the character of these changes in the upper and lower layers of the cortex was of any functional significance. For convenience, I wish to term the upper layers of the cortex supracortical and the lower layers infracortical. In fact, it might be well at times to speak of the supra-

9. Southard, E. E.: *The Stratigraphical Analysis of Finer Cortex Changes in Certain Normal-Looking Brains in Dementia Praecox*, *J. Nerv. & Ment. Dis.* 45:97, 1917.

cortex and the infracortex. The comparative anatomists seem to have demonstrated the importance of some such distinction and the literature has for some time contained references to the so-called suprastellate (supragranular) and infrastellate (infragranular) layers of the cortex. Omitting controversial details, it appears that almost all workers are committed to the idea that the majority of the supracortical structures are of more recent evolution than the majority of the infracortical structures. As many of the mental functions in man are of recent evolutionary origin and as all signs point to the cerebral cortex as somehow engaged in these processes, it seems natural to assume that the supracortical layers, or what we may term the supracortex, are the basis of many of these higher psychic functions. With the same plausibility, we may argue that the infracortical layers, or what we may term the infracortex, is the basis of such mental or quasi-mental functions as are found in those animals possessing an infracortex and not yet a supracortex.

All these interpretations are independent of any topographic conceptions, and for the purposes of generalization one neglects for the moment the important distinction of the archipallium and neopallium, developed by Elliot Smith.

Taking the whole cortex, by and large, modern work seems to me to invest the supracortex with higher psychic functions than the infracortex.

Now in a disease like dementia praecox as psychologically formulated by Bleuler, we find the main feature to lodge in what Bleuler terms schizophrenia. This most valuable term expresses what one might call "split-mindedness" or mental dissociation. Much of modern psychology, whatever may be said to the contrary, is founded on the work of the associationist school of, for example, John Stuart Mill. We should hardly get on without some of Mill's so-called mental chemistry. Well, for better or worse, associative processes must have their obverse in dissociative processes, and the measure of mental dissociation is the degree of schizophrenia in Bleuler's sense. Kraepelin himself, who, on purely clinical grounds of a combination of certain symptoms in certain ways, laid down the conception of dementia praecox, has so far admitted the validity of Bleuler's conception of schizophrenia as to use the term schizophrenic very frequently in his description of patients. For one of the most exquisite examples of schizophrenia, namely, the finely divided cleavage of speech known as *Wortverwirrtheit*, Kraepelin has constructed the term *schizophasia* on the analogue of schizophrenia.

We mean then by schizophrenia a process of mental dissociation, a psycholytic or ideolytic process. The cleavage may lie between the intellect and the emotions, such that the emotions do not at all fit the

ideas entertained by the patient. Or the cleavage may lie between the emotions and the will, and a bizarre-looking conduct may fit a certain quasi-normal state of feeling. But the cleavage is not necessarily so elective and total. The cleavage may be within some particular train of thought. Here is schizophrenia in its best display. Instead of the regular train of thought, we may have a train of thought like a telegraph despatch, or even a train of thought suggesting in its obviously inappropriate sequence a cipher or a set of types reduced to pi. But absolutely pried thinking is not the rule and the so-called word salads are often but passing phases in the development of a dementia praecox course.

MANY EFFECTS OF MENTAL DISSOCIATION PROBABLY CORRELATED
WITH SUPRACORTICAL DISEASE

Here is not the place to expound or to describe schizophrenia. Inasmuch, however, as many of the schizophrenic effects that strike the observer as so bizarre in dementia praecox thinking are probably correlated with the operations of the outer layers, that is, of the supracortex itself, we have to inquire whether cases of this order show lesions preferably in the supracortex. Of my four cases of dementia praecox, all showed lesions in the supracortex in the nature of cell loss and of more or less disproportionate gliosis, except one case. This case was one approximating the so-called paranoia, a disease perhaps allied to dementia praecox, but often running years or throughout life without any of the bizarre psycholytic, schizophrenic, thought-splitting phenomena here under discussion. For paranoiacs of this rare description (there may be in a dozen institutions in Massachusetts at this time not more than twenty-five or thirty of these particular cases), present quasi-normal appearances that have been described sometimes as psychic malformations and often give the impression of ability to fit in to a reconstructed world with the patients in the center as Kaisers or I. W. W. chiefs therein. In short, many of these paranoiacs, victims of the severest and most intractable psychosis known, are nevertheless without a trace of mental splitting such as I have hinted at above. And, in fact, the paranoiac in question showed no signs of mental dissociation, but rather showed signs of what might be termed a hypersynthesis of such facts in her environment as fitted her morbid ego and her jealousies. What I am getting at is that the psychopathologic analysis of this case of paranoia precisely did not demand any evidence of supracortical disease, in fact, had there been supracortical disease of any moment, we should have wondered whether there had not been some disintegration of the patient's personality, at any rate at the close of her life. It is interesting that this particular paranoiac did show some infrastellate dis-

ease which, as will be mentioned below, I regard as correlated with the auditory hallucinations which she showed.

The other three cases intensively examined (I may recall that notes were made as to different types of cell loss, gliosis, satellitosis, vascular changes, etc., for each layer in each of from twenty-five to thirty areas of the cortex in each subject) showed signs of supracortical disorder as well as of infracortical disorder of varying degrees in different parts of the cortex, and all three of these cases showed signs of schizophrenia. This evidence is at least suggestive that supracortical disorder is necessary in schizophrenia. I felt satisfied in my own mind, from the results of the work, that not only is the cerebral cortex the proper study of the psychologist and the psychiatrist, but that the supracortex is in a still more intimate sense the proper study of the psychologist or psychiatrist who has to deal with the higher functions of what may be called psychic association or synthesis. To my mind, such studies, if in future confirmed, will throw an important added light on the problems, already partly illuminated by comparative anatomy.

Let me insist here, if it is not superfluous, on the fact that I am not proposing an hypothesis to the effect that every time a mental split occurs, a cell drops out of the supracortex. I do not even see in my mind's eye a dendrite dropping off a supracortical cell to signalize the cleavage of an idea. There is very properly much fun to be made of workers who regard ideas as fine transparent substances poured in and out of nerve cells as wine in and out of goblets. Aside from the problem of parallelism and interactionism suggested by the figure that regards brain cells as vehicles for ideas, my own contentions deal rather with the observational facts. I would regard all gliosis as merely indicating and not defining the type of cortical disease in question and I should regard the nerve cell losses or other changes as likewise nothing but indicators of the kind of thing going forward, or perhaps as indicators that something or other is going forward in the injured tissue. To be sure, I would think that destructive brain changes would be more likely to be associated with mental dissociation (with schizophrenia, gliosis) than with other types of synthetic or redistributive mental processes. Supracortical neuron destruction, to put the whole matter in a formula, is to my mind correlated with schizophrenic processes. What, you may well ask, is to be correlated with hypersynthetic, falsely synthetic or redistributive mental processes of the mind twist sort? For the present I, for one, have no idea what cortical process corresponds to these nondestructive, morbid psychic processes. Mind lack and mind loss *should* correspond with cell lack and cell loss. What we term figuratively mind twist, for example, false reasoning without loss of sensory intake and power, without

loss of memory images, without loss of power of expression, without any evidence of coarse loss of function, remains as a process not readily statable. Perhaps we must fall back here on the idea of physicochemical changes and of anomalous distributions of energy in normal neuron systems. But these are speculations so remote from observational facts that so far as I can see they cannot even do the observer any harm.

CORRELATIONS OF HALLUCINOSIS AND CATATONIA WITH INFRACORTICAL DISEASE

Besides schizophrenia there are other bizarre effects in dementia praecox. Perhaps the strangest thing in the world is catalepsy. Catalepsy, catatonia, *flexibilitas cerea*, are not infrequent symptoms in many cases of dementia praecox. They all have the character of muscular hypertension somewhat suggestive of hypnotic effects or again of the effects of drugs on the muscular system. Sometimes the phenomenon of negativism and resistivism reminds one of the Sherringtonian experimental effects showing innervation of antagonistic muscle groups. Possibly these processes are to be explained on some general line as schizophrenia; possibly they are due to some kind of lysis; some workers are inclined to use the concept of inhibition very freely in the attempt to explain them. They are often a transient phase recurring again after comparatively normal intervals in a schizophrenic patient, and it seems impossible to evoke them by any form of stimulation of the patient.

In a general way, such conditions as catalepsy seem a good deal more like phenomena producible in lower animals than would schizophrenia. Some of the hypnotic or pseudohypnotic appearances in lower animals roughly resemble the catatonic effect. It was in a case of catatonia that Alzheimer first stated that there were nerve cell changes in dementia praecox, and it will be remembered that he placed these changes (chiefly gliosis) in the lower layers of the cortex. To a certain extent, my own investigations here confirm those of Alzheimer; at all events, in the cases showing catatonia there were lesions in the infracortex.

Another symptom not at all so bizarre as schizophrenia and catatonia is hallucinosis. Hallucinations are rather quasi-normal effects that the normal person rather readily understands and that occur in a great number of mental diseases. Hallucinosis is in short a far less pathognomonic symptom for dementia praecox than is either schizophrenia or catatonia. Many forms of hallucination seem to be of so simple a nature that they would well be elicited in the lower animals, could we only get at the psychic interiors of the lower animals to learn their mental contents. A priori, therefore, it seemed to me that

the disease process underlying hallucinosis ought to be in the infracortex rather than in the supracortex, and there was some confirmation of this idea in the case studied. I mentioned in the foregoing the fact that late in the disease, the paranoiac patient developed auditory hallucinosis. She showed infracortical cell loss of a mild but distinct degree. It will be remembered that the brain of this case was the most nearly normal of all the brains so far studied in the whole series.

The stratigraphical analysis of these brains accordingly proved very alluring. I seemed to get evidence that the supracortex was a region whose disease might well spell schizophrenia, whereas the infracortex was a region whose disease was related with lower level symptoms, such as catatonia and hallucinosis. The supracortex and the infracortex would then be regions of differential interest for the psychiatric investigator, who would seek in the supracortical region for evidences of higher intellectual disorder in the field of association, combination and abstraction, and in the infracortex for evidences of lower forms of mental disorder, such as catalepsy and hallucinations. I would not stick on the question of higher and lower functions at this point. Catatonia may well be a far more complex matter than many forms of intellectual dissociation; I call it lower because it seems to me that a simpler organism could show catalepsy rather than disorders of combination and abstraction in the intellectual field.

I have recently reviewed the cell findings in the different cortical areas, assuming that I should find rather suggestive topical correlations between special kinds of symptom and special loci. I assumed that a priori no one would be likely to hunt for the source of auditory hallucinations in the smell zone as defined by the comparative anatomists, and that one would hardly be likely to look for the basis of visual hallucinations in the superior temporal gyrus!

Perhaps in accordance with the opinion of the learned psychopathologist above mentioned, it is a priori certain that in point of fact auditory hallucinations have their basis somewhere in the temporal lobe and visual hallucinations somewhere in the occipital region, and why undertake a superfluous task of setting out exactly where and under what conditions they occur? We ought to be helped greatly in this matter by the focality of lesions in dementia praecox.

TENDENCY TO LOBAR AND LOBULAR FOCALITY OF LESIONS

In the beginning I had been attracted by the fact that there was often a lobar or lobular hypoplasia, atrophy or sclerosis in these brains. In fact I had tried, reasoning from the gross data alone, to draw tentative conclusions as to the main lines of functional differentiation in the symptoms of dementia praecox.

Noting how difficult was the distinction between inborn anomaly and acquired lesion and how uncertain one might be that a given hypoplasia had anything to do with a given disorder of function, I felt that I ought perhaps to investigate cases without gross lesions.

Now one of the most generally significant results of this intensive examination of numerous areas and all layers in dementia praecox brains is that there is a certain focality in the microscopic lesions. I still find the focality to be rather a lobar or lobular one than an intragyral focality. To be sure, my colleague, Dr. H. I. Gosline, has made some interesting observations on some exquisitely focal lesions of intragyral distribution, possibly related with tuberculosis, in certain dementia praecox brains.¹⁰ Gosline has endeavored to show that the situation of these lesions (demonstrable by fat strains) is such as to fit with my own older contentions as to the relation of certain symptoms to particular regions. Notably Gosline endeavors to confirm my idea of the correlation of catatonia to postcentral lesions. My own work, as here reported, deals not with results of fat stains, but with the results of the study of cell losses by the ordinary tinctorial methods for determination of tubercle, at least with nerve cells (cresyl violet after formalin fixation). I have tried to show the cell losses thus made out as a little more reliable than the fat-stained cells and deposits that Alzheimer, Cotton and Gosline have used. Using the methods of these observers, I obtain too rich a display of lesions, as a rule, to permit correlation.

The kind of focality of lesions which I believe to have demonstrated in these brains is not intragyral, but lobar and lobular, or in certain cases a focality of lesions affecting the whole gyrus. By and large in these brains, as one examines the different layers within a gyrus, the layers are apt to show throughout the gyrus the same kind of lesions, whether gliosis or cell losses. In short the focality of these lesions is not the focality of tubercles, tumor masses, glanders lesions or exudative lesions. It is rather a focality such that, for example, the postcentral gyrus on one side is affected in a certain way throughout the gyrus with such and such layers homogeneously affected. The postcentral gyrus of the other side is relatively normal.

What now are the functional results of a study of the topographic distribution of the lesions just mentioned? Can we by focalizing attention on certain gyri discover functional correlations of lesions with certain symptoms?

10. Gosline: *Paresis or Dementia Praecox?* Boston M. & S. J. 177: No. 10, 1917.

The functional correlations of my dementia praecox studies published in 1910 and 1914-1915 were summed up from the topographical point of view as follows:

1. Delusions are, as a rule, based on frontal lobe disease.
2. Catatonic symptoms are, as a rule, based on parietal lobe disease.
3. Auditory hallucinosis is, as a rule, based on temporal lobe disease.

Re the frontal lobe correlation with delusions, I found an exceptional group of delusional cases without frontal emphasis of lesions; but I found a plausible reason for these exceptions. On analysis, the nonfrontal cases of delusion formation turned out to be cases with a tendency to what may be termed hyperphantasia, that is, to an elaboration of phantasies not more than half believed, or at any rate not fully believed, by the patient. It is clear that from what we know of the probabilities of localization in the brain, both from a comparative and anatomoclinical point of view, the parietal lobes might plausibly be implicated in the function of imagination, and that parietal disease might well be attended with functional disorders of imagination, such as overimagination or what is here termed hyperphantasia.

It is plausible to argue that because the parietal tissue, newly evolved in the higher animals, lying between the tactile postcentral region and the visual occipital region and the auditory temporal region, should be a tissue related with apparatus for combining these sensory data, a tissue which might unobjectionably be termed a center for combining percepts and concepts involving two or more forms of sensation or perception. Whatever the merits of this a priori contention, at all events I found a tempting correlation of phantastic delusions with parietal lobe atrophy.

I summed up the anatomic situation as follows:

On the whole, the correlation between delusions and focal brain atrophy (or aplasia capped by atrophy?) is very strong, particularly if we distinguish (1) the more frequent form of delusions with frontal lobe correlations from (2) a less frequent form with parietal lobe correlations.

The nonfrontal group of delusion formations, the writer wishes to group provisionally under the term *hyperphantasia*, emphasizing the overimagination or perverted imagination of these cases, the frequent lack of any appropriate conduct-disorder in the patients harboring such delusions, and the a priori likelihood that these cases should turn out to have posterior association center disease rather than disease of the anterior association center. This anatomic correlation is in fact the one observed.

My previous work had also suggested a possible correlation between catatonic phenomena and parietal (including postcentral) disease. Ten of fourteen definitely catatonic cases yielded gross lesions in the

parietal or other post-rolandic regions. Of the remaining four, two, negative in the gross, proved to be microscopically altered in the parietal region, and there were indications of a correlation in the remaining two cases. It must be remembered with respect to correlation that I am using the term "catatonic" here as the name of a symptom. I am not offering a correlation between anatomic or microscopic lesions and the catatonic form of dementia praecox.

For example, the symptom *flexibilitas cerea* is not necessarily an indicator that the victim belongs in the so-called catatonic form of dementia praecox, despite the fact that *flexibilitas cerea* is one of the prettiest examples of catatonia ever described. Four of the five cases in the 1914-1915 series that showed *flexibilitas cerea* had parietal anomalies or atrophies; and the fifth case, though it was entirely negative in the gross, was one which showed an extreme degree of satellitosis in the postcentral region examined microscopically. These observations and certain a priori considerations led me to formulate the idea that catatonia, and particularly *flexibilitas cerea*, was a form of disorder of kinaesthesia.

Re the correlation of auditory hallucinosis with temporal lobe lesions, it is easy to see that such a correlation ought to exist if any gross correlations at all were expected. In point of fact, nine of my twelve hallucinating cases have had temporal lobe atrophy or aplasia. One of the three remaining cases had ample microscopic changes in the temporal lobes; one was clinically somewhat doubtful and, in fine, only one of the twelve hallucinating cases could be safely said to have neither gross lesions nor important microscopic lesions in the temporal area.

To sum up then: (1) we expect frontal lobe lesions in cases of delusion formation, provided that the delusion formation is not of the phantastic and overimaginative sort, whereupon parietal lesions would be expected; (2) we expect parietal lesions associated with catatonic symptoms, and (3) we expect temporal lobe lesions in cases of auditory hallucinosis.

ANALYSIS OF FOUR CASES

Accordingly, I have collected the microscopic data in the four cases at present under discussion under these heads—frontal, parietal and temporal. For convenience I have divided the cortex into three portions—frontal, parieto-occipital and temporosphenoidal. The following table indicates the extent of nerve cell loss and of neuroglia proliferation, separately in the three regions mentioned:

It is clear from inspection of the table that Case 1 (10.9) stands out as a case in which the parenchymal disease is especially parieto-occipital, since in ten loci seventeen instances of nerve cell losses in

different layers were found. Here then should be a case with catatonia unless perchance the lesions in the parieto-occipital area should be exquisitely occipital and not affect kinesthetic areas. In point of fact the lesions enumerated are all in the postcentral, superior and inferior parietal areas and are especially marked in the inferior part of the postcentral gyrus and in the superior parietal region on both sides.

SHOWING EXTENT OF NERVE CELL LOSS AND OF NEUROGLIA PROLIFERATION

	Case I (10.9) Duration 14 Yrs.	Case II (12.41) Duration 10 Yrs.	Case III (12.47) Duration 2 Yrs.	Case IV (11.36) Duration 20 Mos.
Frontal loci	9	9	9	6
Nerve cell losses	5	44	35	34
Neuroglia proliferation	7	8	4	3
Parieto-occipital loci	10	9	10	7
Nerve cell losses	17	47	54	19
Neuroglia proliferation	8	8	2	8
Temporosphenoidal loci	10	10	10	6
Nerve cell losses	9	48	50	25
Neuroglia proliferation	5	9	1	0

This patient was one that developed characteristic catatonic symptoms, including *flexibilitas cerea* and attitudinizing in the last two years of her life. She also had auditory hallucinosis in those years, and showed, as the table indicates, a number of parenchymal losses in the proper area, especially in the superior temporal gyrus. Both the parietal and the temporal lesions were largely infracortical in distribution, in accord with the argument mentioned in the foregoing as to the infracortical origin of catatonia and hallucinosis. It will be noticed from the table that there were comparatively few lesions in the frontal region. The case was one of delusions of jealousy and might have been expected to have shown frontal lesions, which, however, were not greatly in evidence. However, on closer analysis of the delusions, it will be found that they are of a synthetic character and not of a schizophrenic character. They are quasi-normal, and it is not easy to conceive just what histologic basis such delusions *ought* to have. At all events none of any consequence were found, and the frontal region remains practically destitute of any parenchymal loss and has exceedingly slight evidence of gliosis. Accordingly we may suppose that we are getting histologic evidence in this case merely of the terminal hallucinosis and catatonia and not of the essential paranoia of the patient.

If we turn to Case 2 (12.41) we find a totally different situation. The amount of parenchymal loss, as indicated by the number of loci, is far larger than in Case 1 (10.9). In fact, there are four times as many foci affected, and the lesions are scattered throughout all three regions—frontal, parietal and temporal. There are relatively more parenchymal losses in the frontal region than in the temporal region and relatively more in the temporal region than in the parietal region.

If we took these data on their face value, we should say that this case ought to be predominantly delusional, but also hallucinatory and catatonic.

There was some question whether the patient was not slightly feeble-minded to start with. However, her command of theological verbiage was large, and she was always self-supporting up to the time of her psychosis. My point in mentioning this query is that very possibly some of the apparent parenchymal losses are actually due to an initial lack of cells. The interpretation of an initial *lack* of cells in any of these areas would of course look in a different direction from that of an initial *loss* of cells. An initial lack in frontal cells might not at all suggest delusional tendencies; an initial lack of superior temporal cells likewise might have nothing to do with auditory hallucinosis. And a simply constructed parietal mechanism would not necessarily entail disorders of kinesthesia with the production of catatonia.

But taking the parenchymal deficiency as signifying initial *loss*, let us inquire what the symptoms of this case are. Was it predominantly delusional? She showed hallucinations of a doubtful but probably of a hypnagogic visual nature. It is not clear that she ever had auditory hallucinations. The appearance of parenchymal loss has proceeded in all these areas to a marked degree, so marked, in fact, that it is rather surprising that there was no gross evidence of brain atrophy (the brain weighed 1,130 gm., possibly a slight reduction from the normal weight; the patient was cardiac and there was such a condition of infiltration of the brain tissue that we can *post hoc* readily believe the brain was slightly and diffusely swollen). In short, the lesions in this brain are so numerous and widespread, and so affect both the supracortical and the infracortical regions that correlations of the nature here attempted are impossible. One can find a correlation between almost any symptoms and some properly situated lesion in this case. The patient was deluded, hallucinated and catatonic, and had frontal, temporal and parietal lesions.

Let us, for the sake of argument, regard the frontal lobe delusion correlation as established; let us regard the parieto-occipital correlation with "feelings of being hypnotized" and the "black cat jumping

over a pitcher" as indicators of disease in the parieto-occipital or occipital areas. How then shall we interpret the absence of auditory hallucinations? Without invoking the poverty of clinical observation and the fact that the patient may have kept auditory hallucinations to herself (she was, in point of fact, often engaged in vituperative language, some of which may have been of hallucinatory origin or of a responsive nature), we must be interested in the fact that some of the temporal lesions shown are exceedingly heavy and affect both the supracortex and the infracortex. Suppose infracortical, temporal lobe lesions of a nature suitable to produce hallucinations (we are still ignorant just what sort of lesion ought to produce hallucinations), would it be too speculative to suggest that the existence of severe supracortical lesions might well interfere with the proper combination and abstraction of the infracortical data in such wise as to produce conscious hallucinations? That is to say, the total supracortical and infracortical mechanism may be conceived to be so altered that, though the conditions for hallucinosis are present in the infracortical zone, the hallucinations are not purveyed through lack of finer connections with the higher psychic apparatus mediated by the supracortical layers. Naturally, I do not wish to claim more than speculative value for such considerations. It is along these lines, however, that I feel that much important correlation will be secured in future.

If we inspect the table of local distribution of lesions in Case 3 (12.47), we find conditions approximating those of Case 2 (12.41), although the duration of Case 3 is far less than that of Case 2. We find here that the parieto-occipital region has numerous lesions and slightly in excess of lesions, also numerous, in the frontal and temporal areas. The case was a catatonic one and in fact, showed both *flexibilitas cerea* and catatonic stupor, and would probably be classified as a case of catatonic dementia praecox. It appeared that she had auditory hallucinations which she tried to keep out by covering her head with her arms; but the content of these hallucinations was never made out. An attitude of apprehensiveness, an early phase in which she constantly repeated the words "Father Patterson," "Father Patterson," led us to the idea that she had delusions of persecution, or else that she was extremely apprehensive and threw a delusional coloring over every-day features of the environment. The most pronounced regions of cell loss were in the infracortical portions of the parietal and temporal regions.

When we come to the analysis of Case 4 (11.36), we find that the parieto-occipital lesions are far fewer in number, and that the case is more one of losses in the frontal and temporosphenoidal areas. This case, therefore, should show delusions and possibly auditory hallucinations. She never showed convincing catatonic symptoms,

although she showed a marked mania and hyperkinesis somewhat suggestive of manic-depressive psychosis. She showed characteristic auditory hallucinosis, and it appears that most of her antisocial acts of a mischievous and silly nature were based on these hallucinations. That she showed definite delusions, for example, of persecution or of poisoning, is doubtful. We know little of her history immediately after the onset of mental symptoms which followed confinement in a hospital for consumptives. Throughout her period of observation in a hospital for the insane, she showed elation, erotism, mischievousness and silliness somewhat suggestive of manic-depressive psychosis and again somewhat suggestive of the elation of certain paretics. The cell losses in frontal region were numerous and both supracortical and infracortical in distribution. It is interesting that of all four cases, this one was the case which showed a marked myelin sheath disorder, a disorder so marked as somewhat to suggest the disappearance of fibers in paresis. The supraradiary fibers were absent in all the frontal regions examined and there was a thinning of fibers in the white matter underneath. In short, the disorder in this case was much more than a fine disorder of minor cell mechanisms and approached the more general and global disorder of paresis, though of course without exudation. On some such lines I would be tempted to try to explain the absence of definite delusions except those based on hallucinations and irritability. I should be tempted to regard the frontal lobe lesions as of such degree that we might think of the case as one that had lost its frontal inhibitions. At the same time, it must be remembered that no coarse atrophy of the brain had supervened, unless we regard the brain weight—1,140 gm.—as demonstrating brain atrophy.

SUMMARY

Thanks to the work of Elliot Smith, Bolton, Campbell, Brodmann, Ramon y Cajal and others, the neuropathologist can now afford to attempt finer functional histologic correlations in the field of mental diseases, thus aiding in the problems of microlocalization. The anti-localizing tendencies of the Wundtians and the interest in merely logical categories taken by Freudians should not interfere with progress in microlocalization. Dementia praecox, for example, can be called a matter of maladaptation of the patient to his environment or of the patient to himself and also a disease characterized by cortical changes.

Previous work had shown anomalies in a high proportion of dementia praecox brains and in a correspondingly low proportion of the brains of manic-depressive subjects. These anomalies may well be interpreted as weak places in these dementia praecox brains, and the

brains in fact are apt to show scleroses and atrophic processes over and above the anomalies. But certain perfectly normal-looking brains in dementia praecox also show the same microscopic changes in lesser degrees than are found in the anomalous sclerotic and atrophic brains. The problem of the present communication has been to work out the focality of these microscopic lesions in a few normal-looking brains studied with unusual intensiveness. In the same series of brains, work of previous seasons had shown a dissociation of parenchymatous (neuronic) and interstitial (neuroglia) changes, indicating a tendency on the part of cortex pathology to resemble the pathology of the kidney. But the majority of brains show mixtures of the parenchymatous (neuronic) and the interstitial (neuroglia) lesions. Recent work in comparative anatomy indicates the rather fundamental importance of distinguishing the functions of the upper cortical layers (what may be called the supracortex) from the functions of the lower cortical layers (what may be called the infracortex). The finer processes of mental dissociation (schizophrenia) *ought* to be correlated with lesions of the supracortex, and such lesions were found in cases with evidence of schizophrenia.

On the other hand, in a case of delusions characterized by no splitting (schizophrenia) whatever, but rather by a process of over-elaborate synthesis, there was no evidence of supracortical disorder and in fact, no proposal can be made for any histologic correlate with this process of oversynthesis.

Other processes equally characteristic of dementia praecox, but logically far simpler in their make-up, such as auditory hallucinosis and muscular hypertension (catatonia), received suggestive correlation with processes in the lower layers of the temporal and parietal regions, respectively.

As far as the tissues of these four cases go, there is little or nothing inconsistent in the findings with the hypothesis that ordinary (non-phantic) delusions are correlated with frontal rather than with otherwise situated lesions; but the supracortical type of delusions found in certain long-standing paranoiacs whose fine mental processes run in a quasi-normal manner, find no special correlation in any region, and the probable lines on which this problem is to be solved remain obscure.

As for auditory hallucinosis, the work seems to afford the expected correlation with temporal lesions. In one case, however, temporal lesions of considerable severity were not attended in life by hallucinations of hearing, but in this case there was also a severe supracortical disease of the temporal region, and it may be that for the production of hallucinations, some congress is necessary between the activation of the supracortex and infracortex, respectively.

In previous work on this series, the brains had indicated a postcentral and superior parietal correlation for catatonia whose muscular hypertension was accordingly regarded as very possibly a kind of morbid kinesthesia. Present work suggests that the anatomic correlate is not merely to the postcentral and parietal regions, but still more specifically to the infracortical parts of these regions.

It may be suggested that the lesions found in samples of tissue in the postcentral, superior parietal, inferior parietal and superior temporal regions indicate a certain systemic tendency in the underlying processes. For these lesions were bilateral and occurred, as it were, in two continuous sheets of tissue on both flanks of the brain in one of the best defined of our cases; these flank lesions were not attended by any similar lesions of the frontal, precentral, occipital and lower temporal and smell regions. The nature of a process which could mildly affect nerve cells and neuroglia on two sides of the brain and also specially affect the infracortical rather than the supracortical portions of these affected sheets of tissue remains a mystery. It is perhaps no greater mystery than that which attends the distribution of lesions in the spinal cord of pernicious anemia. It remains unsettled whether these lesions are secondary in point of time to a noncell-destructive phase in the disease, or whether the lesions of which these microscopic effects are indicators began *pari passu* with the symptoms — that is, it remains a question whether we are dealing with the excess wear-and-tear process of cell mechanisms morbidly employed or whether the morbidity of neural function is an exact equivalent of the neuronc and neuroglia morbidity.

THE HISTOGENESIS OF MULTIPLE SCLEROSIS *

THEOPHIL KLINGMAN, M.D.

ANN ARBOR, MICH.

(This article is concluded from page 64 in the January number)

The so-called "areolar areas" show a distention of the perivascular glia network with the glia relatively unaltered. Large spaces are thus formed, some of which open into adjoining meshes by breaking through the septa separating them; the broken ends appear projecting into the large meshes which have become more or less distended into one large space. Within this area the myelin sheaths have disappeared and in most cases the axis cylinders also, or they are still indicated by small, slightly stained, round or ovoid masses of the margin of the spaces. Most of the spaces are empty, though some of them contain small irregular granules and portions of fibers. The constituent elements of the vessel walls are more or less separated; in some of the vessels wide spaces are formed between the connective tissue trabeculae of the adventitial sheath. These spaces frequently contain more or less debris.

An area of more or less dense glia tissue surrounds this space forming a definite transition zone, the meshes of which contain numerous epithelioid cells. The blood vessels of the peripheral zone show a marked accumulation of nuclei in the adventitial sheaths. The myelin sheaths show varying degrees of disintegration which is indicated by the variation of color in the Bielschowsky preparations. In much of the zone it is entirely absent. In the most peripheral part of the transition zone there are large protoplasmic glia cells and an increase in the nuclei belonging to the small glia elements.

It is evident that the "areolar areas" of this type are the result of a more rapid and intense process, that is, an exudate, the result of a stasis from the blocking of a blood vessel, which is followed by a rapid degeneration of the nerve elements and a compensatory reaction in the neuroglia tissue of the transition zone. Many of these areas are not unlike those resulting from an arteriosclerosis softening, in which there is a central space with remnants of the blood vessel wall and granular debris with an areolar transition zone of denser neuroglia tissue in the meshes of which are large epithelioid cells and large multinucleated glia cells in the most peripheral portion. There are areas in which the myelin degeneration is but slight, especially at the periph-

* From the laboratory of the State Psychopathic Hospital.

eral part of the area. The glia meshes are distended, but there is no marked change in the density of the neuroglia tissue. Fat granule cells are entirely absent both in the tissue spaces and the vessel wall as shown by the Herxheimer and other stains. The Mallory and toluidin blue preparations show numerous large multinucleated glia cells presenting fibril formation. However, this is not sufficient to cause any marked change in the density of the glia meshes and the process is apparently arrested. The picture is that which is frequently met with after resolution following an edema in disorders of the circulation. We thus have two types of areolar areas: one, the picture of complete resolution without disturbing the original glia meshes; the other, a more advanced process with thickening of the glia meshes and marked myelin degeneration (Plate VIII, Fig. I). Both of these pictures come under the head of secondary changes. The former is an area surrounding one of the branches of a vessel involved in the primary lesion (Plate II, Fig. II), the latter a secondary area of the vessel in which the primary lesion occurs (Plate II, Fig. I). The "areolar zone" of some of the writers is an area surrounding a more rapidly forming sclerosis and which was completed or arrested before the transition zone had reached its terminal stage.

In the brain there are frequently found nonmyelinated devastated areas in the central part of which there appears a small vessel around which are large free spaces surrounded by a wall of dense glia fibrils comparatively free from nuclei. In cross-section the vessels appear torn loose from the surrounding tissue or remain attached by only a few strands of adventitial tissue stretching across the open space. Some of the vessel walls are but little altered, others are almost beyond recognition except for a thin circular strand. Within the space there is a coagulum containing debris, the remains of pigment and fat granule cells. In the lumen of the vessels there are often remnants of the constituent elements of the blood. The lumen of most of the smaller vessels is perfectly clear. Around each vessel the myelia is absent. Both large and small glia cells are proliferating. Sometimes several of these areas coalesce and form larger irregular areas. In the toluidin blue preparations the picture is that of multiple areas of devastation, the result of thrombosis. These perivascular sievelike areas (Plate IX, Fig. III) are probably the result of a circulatory obstruction in the distal branches of the blood vessel in which the primary lesion occurs resulting in a lymph stasis and softening.

SYNOPSIS OF PART II

The various areas described under the second head can be grouped to a large extent as the successive stages of a process which terminates in a secondary sclerosis. Five such stages can be clearly differentiated:

1. Edema and mononuclear cell infiltration.
2. Fat granular cell myelitis.
3. Neuroglia fiber formation.
4. Sclerosis.
5. Retrogression of neuroglia cells, and fat granule cells.

The characteristic microscopic picture presented under low magnification in the toluidin blue and van Gieson preparations shows a demyelinated area having three definite nucleated zones arranged around the lumen of a blood vessel.

The innermost zone involves the vessel wall and the perivascular lymph spaces, and consists mainly of mononuclear epithelioid cells and other mesodermal elements.

The second zone is formed by a cell proliferation in the marginal neuroglia tissue. The cells are large, protoplasmic cells and small neuroglia elements as well as ameboid cells.

The third and most peripheral zone consists of a diffuse neuroglia fiber proliferation in the normal tissue surrounding the perivascular neuroglia zone in which there is an increased number of nuclei and enlarged normal spider cells.

The *first stage* in the development of the secondary sclerotic area is characterized by a swelling of the structural elements and faint staining of a circumscribed area. The nuclei of the vessel wall are increased. There are a great number of nuclei in the perivascular marginal glia tissue and in the peripheral zone the normal spider cells are distinctly enlarged and their nuclei, the protoplasm and their processes show a lighter stain. The myelin and axis cylinders are swollen and faintly stained.

The *second stage* in the process shows large epithelioid cells in the distended meshes of the tissue of the vessel wall and the perivascular lymph spaces. Many of these cells, which are present in large numbers, are fully developed fat granule cells. In the marginal glia tissue there are large multinucleated spider cells with extensive processes. Changes in the peripheral transition zone indicate an exaggeration of all of the elements in a normally retained architecture. The myelin sheaths and axis cylinders are disintegrating.

The *third stage* is the stage of fiber formation in all of the zones. A proliferation of the connective tissue of the vessel wall, marked increase in the fibers of the marginal zone and of the peripheral transition zone with a corresponding myelin sheath and axis cylinder degeneration.

The *fourth stage*, or the stage of sclerosis, is characterized by a dense fiber structure in which the nuclear elements have diminished and the myelin sheaths are no longer in evidence except irregularly

in the peripheral transition zone. The axis cylinders are but few, and those persisting are almost beyond recognition.

The *fifth stage*, or the stage of retrogression, presents a structureless homogeneous demyelinated area. The blood vessel has disintegrated and a homogeneous mass replaces it. The marginal glia zone shows no fiber structure, the fibers have fused into a continuous matrix in which there is seen an occasional nucleus, or a persistent axis cylinder.

The peripheral transition zone shows a dense neuroglia tissue meshwork with few nuclei and a few axis cylinders. The myelin degeneration fades out irregularly and gradually into the normal tissue. The other areas (perivascular sievelike areas, areolar areas and areolar zones) which were described under the second head but could not be placed as definite consecutive stages of the process of secondary sclerosis, will be referred to later.

III. PROCESS OF EVOLUTION

The *process of evolution of neuronie elements* is incident to the evolution of neuroglia elements in the primary lesion of the nerve root.

In three of the cases here cited the ventral and dorsal spinal roots and the intramedullary root-zones and the central gray commissure presented microscopically, nodules differing in structure, and with the various stains, in color, from the foregoing.

Cross-sections of the lower cervical, the upper thoracic and the lumbosacral regions showed a number of such nodules. These nodules are situated in the extramedullary portion of the ventral and the dorsal nerve roots, and extend into the medullary substance of the cord in the region of the root-zones. A number of such nodules are found along the mesial border of the posterior gray horns and within the central gray in the region of the central artery and vein. Nodules of this character were not found in the sections of the brain tissue.

In the van Gieson and Weigert preparation of the spinal cord, the nodules appear to have a close relationship with the pia mater and the blood vessels. They involve especially the pia septa of the posterior columns and the extra medullary pial sheath of the nerve roots (Plate V, Figs. I and II). In the central gray substance they are sharply circumscribed areas with an intervening clear space encircling the nodule, and for but a few fiber strands they are completely isolated from the surrounding tissue (Plate IV, Fig. II—24, and Plate V, Fig. IV). In the pial spaces they form nodules in the vessel wall either on one side or surround the vessel more or less completely. In the white matter they lie free and completely isolated from the nervous elements, though invariably within the adventitia of a vessel.

giving the impression that the connective tissue had secondarily involved the nodule or that the process had arisen from the vessel wall itself. The area around the nodules shows a dense glia fiber proliferation with few nuclei. In the van Gieson preparations under higher magnification, the structure of these nodules presents in longitudinal and transverse cut sections, intertwining fibers containing numerous characteristic nuclei.

The longitudinally cut fibers were stained yellowish-green with a central pink stripe or a deep blue-black center containing a fine pink line which at irregular intervals shows an elongated nucleus in relation to it. The transversely cut fibers have a sharp contour because of the differential stain. The outer zone stains yellowish-green in which there appears a pink ring showing an occasional nucleus. In the center is a deeply stained point which varies somewhat in size and color in the different areas. There are other fibers lying between these which are apparently fine fibrillar connective tissue staining intensely pink and containing elongated nuclei with their long axis sometimes parallel but more often transverse to the fibers. The fibers are densely interlaced and have a whirl arrangement. The nuclei are numerous and of varying types. Those in intimate relation with the nerverlike fibers are deeply stained elongated bodies with blurred ends having a distinct network and membrane, but no nucleolus. The long axis of these bodies is parallel to the long axis of the fibers. Some of these appear as broken off at the end; from this broken end, long fibers seem to extend. Other elongated nuclei are not so deeply stained, they are elongated bodies containing a nucleolus. They lie either parallel or transverse in the fine fibrillar connective tissue. Endothelial cells could be distinguished from the other forms by their oval shape, lighter stain, usually containing a nucleolus and their location near the lumen of the blood vessel. In the ramification of the fibers either in the deeper part of the nodule or at the periphery, small fusiform nucleated elements are arranged end to end forming chains apparently in line with the fibers. In the Weigert myelin sheath stain the nodules stain nearly as deep as the surrounding white matter. However, under higher magnification the individual fibers are more faintly stained than the normal fibers and the deeper stain of the nodule as a whole is dependent on a closer opposition of the fibers. In the Bielschowsky preparations the fibers show numerous irregularities and varicose enlargements, here and there delicate twigs are given off which wind around larger fibers and sometimes form into a plexus.

Closely associated with the nodules in the intramedullary portion of the anterior and posterior nerve roots and in the pia mater of the

extramedullary root zone there are areas composed of dense fibrous tissue. Fiber strands appear to extend from this region into the cord and can be traced to the mesial side of the posterior horns and to the base of the anterior horn where they spread out to form a dense area of fibrous tissue. A similar fibrosis occurs in demyelinated portions of the anterior and posterior nerve-roots. These areas consist of a meshwork of finer and coarser fibers among which are small accumulations of lymphocyte-like cells with a deeply stained round nucleus. There are a few other cells somewhat larger than these, that have an oval eccentric nucleus placed to one side in which there is a definite chromatic network. In these fibrous root-zones the van Gieson preparations show a differentiation of the fibers, certain deeply stained pink fibers seem isolated which proved to be axis cylinders in the silver preparations. At the margins of the areas of fibrosis there is a dense neuroglia tissue which fades into the normal tissue by a gradually diminishing density.

SYNOPSIS OF PART III

In the lower cervical, upper thoracic and in the lumbosacral regions of the spinal cord there are fasciculated areas of abnormal fibers and small nodules situated in the outer layer of the pia near the root entry, in the intramedullary root-zones and isolated nodules in the gray and white substance of the cord. All of the areas are intimately connected either with the wall of a blood vessel, with the pial septa of the posterior part of the cord or the anterior fissure.

From the foregoing brief description it is apparent that there are certain abnormal formations which differ from the characteristic lesion of multiple sclerosis but bear a certain relation to the disease, and we can distinguish the following:

1. Isolated nucleated areas in the white and gray substance of the spinal cord which involve the wall of the blood vessel and which consist of embryonic neurofibrils and connective tissue having the arrangement and appearance of a peripheral nerve.

2. Areas of fibrous tissue in the pia mater in which embryonic neurofibers are developing.

3. Isolated areas of fibrosis in the intramedullary root zones and in the anterior and posterior roots.

SUMMARY

The four cases of multiple sclerosis on which this investigation is based were the usual cerebrospinal types; unfortunately in one case the spinal cord was not obtained, but from the distribution of the lesion in the brain extending to the end of the bulb there is no doubt that

also in this case the cord was equally involved. Only one of the cases was personally observed during the progress of the disease. The patient died of acute mastoiditis. Another patient died of pneumonia, one died in a convulsion and one from exhaustion following a number of epileptiform seizures. Their ages were 38, 44, 49 and 54 years. The average duration of the disease in these cases was 10 years. All of the cases showed at necropsy a general adenitis with rather marked glandular enlargement in the bronchi and mesentery. One had a healed tuberculous lesion in the left lung.

The method of examination of the brain and spinal cord of the different cases was uniform and the histologic observations were made in preparations of diffuse and differential stains. The demyelinated areas are of various size and form, though mostly round or oval.

In the *ventral and dorsal spinal nerve roots* the areas are more irregular than elsewhere, though sometimes round or ovoid. Some of the areas have sharp cut margins, others show a gradual transition from the unstained to the normally stained tissue. In the *spinal cord* the areas at the periphery, especially at the ventral and dorsal root-entry, are wedge-shaped. The base of the wedge is subpial, the apex extends into the medullary substance. The areas in the posterior columns are elongated oval shape involving either the posterior median septum or the paramedian septum. Isolated round demyelinated areas occur in the ventral and dorsal horns. These have a very abrupt border. In the central gray substance there are sharply circumscribed round areas more deeply stained than the surrounding myelin sheaths; these areas occur also in the white substance between the posterior horns and in the ventral and dorsal nerve-roots and in the pia in these regions. In the lateral columns, large irregular or wedge-shaped demyelinated areas are present and within these are denser areas usually round or ovoid, only their greater density differentiates them from the surrounding sclerosed tissue.

In the *medulla oblongata, pons, cerebral peduncles, and cerebellum* the areas are round or oval, and the confluent areas are here also apparent. The subpial areas are wedge-shaped with broad base peripheralward. The areas extend into the adjoining tissue in the form of broad isolated processes in which a central vessel can be seen. Such extensions from the periventricular tissue involve the cranial nuclei.

Around the posterior and anterior horns of the lateral ventricles and also in the descending horns of the lateral ventricles the sclerosis assumed the form of long fingerlike extensions from the adjoining white matter. In the medullary rays there are also numerous small, round and oval foci.

In the optic thalamus, the caudate and lenticular nucleus, the areas are frequently round, very numerous and small, though sometimes confluent. Within the confluent areas small, round denser areas are apparent which indicate the original foci. Symmetrical involvement of the basal ganglia is strikingly evident.

The internal capsule, the external capsule and claustrum, also the convolutions of the island of Reil show quite round, isolated areas of varying size and a striking symmetry of the two sides. The sieve-like areas around the branches of the lenticulo-striate and strio-thalamic vessels are marked and constant in all of the cases.

It appears that not only these areas, but all of the demyelinated areas occur within the radius of a blood vessel as far as that territory can be determined. The primary sclerosed area is invariably within the vessel zone.

In the cerebral cortex the demyelinated areas are more variable in size and shape than elsewhere. Some of the areas appear as extensions from the white matter into the gray. The shape of these extensions seems to conform to the radiations of the nerve-fibers and appear as elongated sometimes curved or pointed areas. Numerous round or ovoid areas can be made out entirely within the cortex. They may be situated in the tangential layer or in the supraradial or intraradial network. In some of the areas a central vessel was apparent, in others numerous capillary vessels in various positions are seen within them.

Some of the areas appear to spread from the surface inward. Such areas extending from the surface into the convolution are often wedge-shaped, sometimes in the form of an irregularly curved process with its convexity to the surface. The outline of these areas is well defined. Some of them extend as far as the subcortical white matter.

Confluent areas with complete demyelination of a whole convolution and sometimes extending around a sulcus to another convolution was observed.

In the cerebellum, the medullary core is uniformly involved in all of the cases. The demyelinated areas are small, mostly round; the larger ones consist of several confluent areas. The cortex shares in this involvement. Small, round areas are found in almost every section of the cerebellar cortex. None of the areas appear to extend from the cortex to the medullary core, or vice versa. A remarkable symmetry in the cortical areas is also here indicated.

From the foregoing it is apparent that the demyelinated areas are distributed over the entire central nervous system, that they are round or oval, or modifications of these forms when they originate in the medullary substance, cortex or gray substance of the cord, while the subpial areas and the areas in the pial septa are wedge-shaped. In the confluent areas the original round or ovoid focus can be differentiated.

TYPES OF DEMYELINATED AREAS IN THE WEIGERT-PAL AND
KULSCHITZKY PREPARATIONS

From the standpoint of demyelination there are *three definite types of areas*. However, a fourth type is apparent because of a more intense myelin sheath stain than in the normal tissue.

1. (Plate IV; Plate V, Fig. II; Plate VIII, Fig. IV). The limits of such an area is abrupt, and there is no gradual restoration of the normal color in the tissue surrounding it. In the area itself the medullary sheaths have entirely perished, and there is no evidence of the products of degeneration. From the earliest period of development the processes of new formation, disintegration of the myelin sheaths and retrogression of cellular elements are relatively proportionate. The characteristic demyelination of this type is that the myelin sheaths appear thinner but definitely stained. In longitudinal section one observes a number of very fine granules and some larger spherical bodies which are attached to the outer well stained border of the myelin sheath, and as these break away and disappear others are formed until the myelin gradually becomes thinner, and finally a series of these bodies represents the remnant of the myelin sheath which undergoes the same process.

2. (Plate I, Fig. IV and Plate XII, Fig. I). Here the demyelination presents itself in various forms. Early in the process the area is diffusely stained and appears edematous, the whole ring of myelin is broken up into smaller and larger globules with smaller intervening granules. In longitudinal section, there are exaggerated varicosities of the fibers and the whole fiber is broken up into large oval vesicles; some of these are found in the more central part of the area where the demyelination is well advanced. The peripheral zone shows an irregular disintegration of the myelin sheath in the same manner. There are many badly stained fibers and the limits of such an area depend on a gradual and irregular restoration of the normal stain of the myelin sheaths. The process of new formation does not keep pace with the process of disintegration in the areas of this type.

3. (Plate VIII, Fig. I). Such areas are more or less tumefied. The whole area is diffusely stained, the individual fibers are not well stained and the myelin degeneration occurs simultaneously in the whole area. The myelin sheath is rapidly broken up into variable segments. These areas are not sharply defined, and under higher magnification show a gradual increasing intensity of the normal myelin sheath stain toward the periphery. The process completed shows a demyelinated area containing small irregular empty spaces with thickened septa; occasionally there are larger spaces within them which appear to be

the result of a confluence of several of the smaller spaces indicated by the projecting broken ends of the dividing tissue.

4. (Plate VII, Fig. IV—43). There are well defined areas in the spinal cord and nerve-roots because of a deeper staining. However, under higher magnification it is shown that this is dependent on the greater density of the myelinated fibers. The individual fibers are not so deeply stained as the normal fibers in the surrounding tissue. The areas are sharply circumscribed, consisting of elongated irregularly coursing fibers with connecting bridges forming a reticulum in the wall of a blood vessel, the lumen of which is distinguished in the center or toward the periphery of the area. Some of the fibers stain more deeply than others, and all of them, while variable in size, are finer than the fibers in the normal tissue. The tissue surrounding these areas shows a contrast to the normal tissue by its paler staining.

BIELSCHOWSKY AXIS CYLINDER PREPARATIONS

The *Bielschowsky axis cylinder* preparations present histologic variations in the three types of demyelinated areas which are in accord with the process of disintegration of the myelin sheaths in the respective areas. In the fourth type they present no degenerative changes, but not any of the axis cylinders are fully developed normal nerve-fibrils.

1. (Plate IX, Fig. II; Plate IV, Fig. IV.—42). Maintaining the classification adopted in describing the myelin sheath preparations, the area of this type is striking for the comparative persistence of the axis cylinders. While this persistence is only a relative one the changes which lead to the destruction of the axis cylinders in this type are sufficiently characteristic to differentiate them from alterations in other types. In cross-section the remaining axis cylinders appear more prominent than in other areas because of a greater contrast in the color than in the normal tissue. Most of them are larger though some are smaller, they are fewer in number, and while not so well stained the surrounding tissue is nearly colorless. Around each fiber a single or double circle can be distinguished; this is dependent on color contrast as no difference in structure can be seen. There is little change in the position and form of the axis cylinders in the cross-section of the areas of this type at various periods of development. They become more apparent as the areas advance in development by reason of color contrast; the staining qualities of the tissue surrounding the axis cylinders within the area diminish while the axis cylinders themselves appear more dense.

In longitudinal section more definite changes are recognized. In the course of the nerve-fibers there are spindle-shaped enlargements

of various size. They are homogeneous, dense, fairly well stained elements which change little in color with the advancement of the sclerosis, but the variations in size become more apparent, the former narrow spaces separating the axis cylinders from other structures become obliterated by proliferating wavy glia fibrils forming a dense sheath around the persistent nerve-fibrils. The longer axis cylinders can be traced from the sclerotic area into the normal tissue. The change in color is abrupt at the peripheral margin of the demyelinated area and after passing through a narrow transition zone the normal myelinated axis cylinders appear. In the transition zone the nerve-fibers show a slight change in color but no perceptible change in structure, though the variation in size and the irregularity in outline is striking when compared with the normal fibers in the surrounding tissue. There are no demyelinated axis cylinders in the transition zone of this type of demyelinated area.

2. (Plate IX, Fig. I—42). The area belonging to the second class present changes in the axis cylinders which correspond to the degenerative changes following demyelination in other conditions. The earliest observation is a homogeneous swelling which appears in the area as a whole; the axis cylinders become more or less attenuated. The variations in size are striking, very few approach that of normal fibers. In longitudinal section the qualitative changes affect the largest number of fibers and at some time all of the fibers, as there are no persistent axis cylinders in this type, in the sense of that of the primary sclerotic areas.

After the axis cylinders become swollen, they become shrunken irregularly and there appear spindlelike enlargements. These, as well as the thinner parts, become segmented and disintegrate into homogeneous clumps and fine irregular granules.

From the variations in the color it is apparent that there are qualitative differences in them, and some of them persist as isolated bodies and appear in cross-section as irregular dark stained bodies which are with difficulty differentiated from the persistent axis cylinders of the demyelinated area Type I, though they are granular, irregular, more deeply stained, and there are usually secondary granules situated in the same space with the larger ones. In longitudinal section, the appearance of the fibers in the different zones varies apparently only in degree. Isolated axis cylinders can be traced through the sclerotic tissue, and transition zone into the normal tissue. They are swollen and tortuous, in the apparently normal tissue they are easily distinguished, among the normally myelinated fibers they appear as tortuous faintly stained shrunken demyelinated fibrils as far as they can be traced.

3. (Plate IX, Fig. IV). The area of the third variety shows no trace of the original axis cylinders. There are, now and then, irregular deeply stained granules lying in open spaces which may or may not be parts of degenerated axis cylinders. In the sclerosed zone surrounding these areas no axis cylinders could be traced, but color difference in the transition zone appears to be dependent on certain demyelinated deeply stained axis cylinders, which can be traced into the normal tissue as changed myelinated fibers.

4. (Plate VIII, Fig. IV—45). This type appears as deeply stained sharply circumscribed, mostly round masses of fibers. The fibers stain intensely dark and show numerous irregularities and fine varicosities. From the thicker fibers there extend fine branches which frequently end in bulbs. Some of the fine twigs appear to entwine the larger fibers, others form plexuses within the vessel wall where they eventually form a dense interlacing and whirl arrangement.

OTHER PREPARATIONS

The *Mallory phosphotungstic acid hematoxylin* and *Weigert neuroglia stain* and *Alzheimer* and *van Gieson* preparations present changes in the neuroglia tissue which are essentially different in the various types of areas.

1. (Plate VII, Figs. I, II and III.) In the first type the early microscopic picture shows numerous large neuroglia elements in the transformation into glia fibrils and glia nuclei, which in their further evolution form dense concentrically arranged bundles of undulating neuroglia fibers between which there is a dense reticulum of finer fibers with few nuclei. Surrounding these areas there is a neuroglia fiber proliferation with retention of the normal neuroglia architecture. The neuroglia reticulum becomes more dense, the intervening spaces narrower and some of them are obliterated by a fine neuroglia reticulum.

2. (Plate I, Figs. IV and V; Plate VIII, Fig. II.) The second type can be differentiated into three zones. The perivascular and peripheral zones present a dense fiber reticulum with no definite intervening spaces. The fibers are of varying size forming trabeculae which interlace with one another and a reticulum of finer fibrils lying between them which eventually form a dense homogeneous matrix. The innermost zone presents rows of fiber-forming nucleated elements in the adventitia. The fibers have no definite arrangement, but form a dense felt-work. The peripheral zone presents the architecture of normal neuroglia tissue with an increase in the nucleated elements. The neuroglia trabeculae increase in density and a dense neuroglia

reticulum of finer fibers is formed between them. This zone eventually becomes fused with the inner zone.

The transition zone shows an increase in the nuclear elements and an increase in the neuroglia fibers without distorting the normal architecture.

3. (Plate IX, Fig. III.) The third type shows no neuroglia tissue within the area, but the neuroglia tissue surrounding the area shows that the normal architecture is retained, and there is a great density of the fibers and a larger number of nucleated elements. In the brain there are areas (perivascular sievelike areas) containing large open spaces into which project (in longitudinal section) blood vessels or a large space around the vessels (in cross-section) is shown. The spaces within the area are surrounded by a dense wall of neuroglia fibers. The constituent elements of the vessel wall are separated, this forming elongated spaces in which are found the remains of cellular elements.

4 and 5. (Plate II, Fig. II, and Plate VIII, Fig. I.) The fourth and fifth type ("areolar areas and areolar zones") show a single irregular clear space or a number of clear spaces, some of which are confluent. These areas are surrounded by a dense wall of neuroglia tissue, the result of a compensatory reaction in the neuroglia dependent on the destruction of the tissue within the area ("areolar area"). In another but similar type ("areolar zone") the normal architecture of the neuroglia tissue surrounding such areas can be recognized, but the fibers of the trabeculae are more compact.

ANOTHER PREPARATION WHICH SHOWS WIDE VARIATIONS

The *toluidin blue preparations* show a wide variation in the cellular elements of the different types of sclerotic areas. The mesodermal and ectodermal elements are readily classified not only by their structure which is so beautifully brought out, but also by the difference in color.

1. (Plates V, VI and X.) In the actual primary sclerotic area the ectodermal elements predominate; in fact, very few pathologic mesodermal elements enter the primary plaque formation. In the earliest areas there are a large number of large round or slightly oval cells which lie in the adventitial tissue partially or completely surrounding the lumen of a vessel in a single or double layer. The cell protoplasm is colorless and structureless, but sharply circumscribed, in the center of which is a deeply stained grayish-purple to deep blue nucleus with a distinct nuclear wall in which no definite structure can be made out at this time. In their further evolution, as is shown in other areas, they are transformed into various types (17, 34, 8) which can be followed in the evolution of the primary sclerotic area from their first development to the last stage of retrogression (43).

A progressive enlargement of the nuclei is the first change apparent. The chromatic structure of the nucleus becomes differentiated and more or less definitely arranged; at this period the protoplasm around the nucleus becomes deeply stained, which finally extends to all of the cell protoplasm. In many of these large cells there are mitotic figures, others have two or more nuclei and the cell protoplasm shows lines of division. Now there are irregularly triangular cells (34) developing large protoplasmic processes (8) in the margins of which the protoplasm becomes differentiated into fine striae (8) (as is shown in the van Gieson preparations). In other cells the fibril formation is evident in the presence of recurving fibers with the convexity in close proximity with the nucleus (8). The regressive changes in the glia cells are indicated by the various forms of large faintly stained nuclei with little or no protoplasm around them, and finally the large, round, granular bodies showing a dissolution of the nucleus itself, which is also evident in the absence of the nucleated elements in well formed primary sclerotic areas. Around the sclerotic area of this type there are large, irregular, protoplasmic processes extending in all directions; the cytoplasm of the process is faintly stained, their margins are indistinct. The nucleus is large; round or ovoid, well stained with few irregularly distributed chromatic bodies of variable size. These cells are apparently ameboid neuroglia cells which lie in close proximity to the marginal tissue. There are other small nucleated elements which are like the small nucleated elements of the normal neuroglia tissue except that the nuclei are somewhat larger and more deeply stained. Besides these there are numerous spider cells more or less regularly arranged around the sclerotic area.

2. (Plate I, Figs. I, II and III.) The three nucleated zones and the variegated color picture in each makes a striking contrast between the area of this type and the foregoing. The predominance of the mesodermal elements in the secondary sclerotic areas is evident from the very beginning of this process.

In the perivascular zone the largest number of cells are round or irregular ovoid vacuolated bodies of considerable size with a large, round, central or peripheral deep blue nucleus more often situated at the narrowest point in the periphery (9). The cell protoplasm contains deeply stained, blue granules and lumps of variable size and shape. Many show more or less light brown pigment. Some of them are completely filled with this, the nucleus is stained blue and is of uniform chromatic structure. Some of these cells are packed with large irregular granules so that only the nucleus can be recognized. These cells are present in great numbers and lie in spaces between the tissue trabeculae of the media and adventitia. A smaller number of these cells appear in the peripheral nucleated zone where they are

separated from one another by the protoplasmic processes of the enlarged multinucleated neuroglia cells.

The protoplasm of the neuroglia cells takes on a faint purple uniform stain and appears as a homogeneous mass in which there are more or less centrally situated, deeply stained, round, or slightly ovoid nuclei. In some of the cells the cytoplasm is but faintly stained; in these a definite reticulum can be seen which takes on a light purple color; variations in form of the cell body and nucleus can be readily traced as transitions from the newly formed mesodermal elements to the fully developed fat-granule cell. In the same zone there are large irregular multinucleated cell bodies with long protoplasmic processes. The nuclei of these cells stain well, but a lighter blue than the former. They contain numerous small deeply stained granules of uniform distribution. The cell bodies stain faintly or not at all. The cytoplasm is finely granular though a few coarse granules occur in the cellular substance. Variations in these cells and nuclear changes which indicate a mitosis and changes in the protoplasmic processes present fiber formation from the earliest differentiation to complete transformation into neuroglia fibers (van Gieson stain).

The intima of the smaller vessels shows a nuclear increase. There are elongated oval cells showing nuclear and cell division in various stages. The nuclei stain a light blue with a deeply stained purple nucleolus and deep blue chromatic bodies. The cytoplasm stains a pale blue and appears finely granular. Some of the nuclei lie perpendicular and oblique to the vessel wall giving the impression of a migration into the tissue. In the adventitia, aside from the elements already described there are numerous well stained, elongated nuclei, most of which are placed parallel to the adventitial fibers. The nuclei take on a deep blue stain with a nucleolus of a deeper blue color.

In the adventitial spaces there are other types of cells, some of them are almost square with round or ovoid nuclei showing a radial arrangement of the chromatin and more or less deeply stained centralized purple cytoplasm. Other cells, somewhat smaller, are round or slightly ovoid with a comparatively large deeply stained, blue nucleus placed in the center or periphery of a mass of finely granular pink or purple cytoplasm. Irregularly scattered among the other cells are numerous small, well stained nuclei of a light blue color with deep blue chromatic bodies, some of which show a regular radial arrangement; in others, the chromatic bodies are few and not definitely placed.

The peripheral nucleated zone shows principally two types of cells. The largest number are large protoplasmic bodies. They are but faintly stained and take on a pale purple color or a very slight reddish tinge. The cell bodies of some of these elements are apparent only because of a faint, light purple margin which outlines the form of the

cell, the central cytoplasm being colorless. These cells are arranged in rows of one or two layers but frequently separated from one another by somewhat smaller nucleated elements of the enlarged spider cell type. They stand out prominently though fewer in number; they are deeply stained, and for this reason show a striking contrast under low magnification.

In the outermost nucleated zone or the transition zone there are numerous small nuclei among which are irregularly scattered larger elements. The size of the large cells varies, so does their form; some of them are round or irregularly oval. The cytoplasm has a faint purple color, in some there is no stain perceptible, and it is a grayish margin that outlines the cell body. Numerous fine granules are seen uniformly distributed throughout the cell. The nucleus is large, round or oval, sometimes half as large as the cell and takes on a blue color which varies from a deep blue to the most delicate tint. Within the nucleus there are well stained, fine, blue granules. The distribution of the chromatic substance is variable; in the smaller nuclei it appears quite uniform throughout the nucleus, and in the larger nuclei the granules are found only in the periphery—occasionally there are two or three nuclei in this type of cell.

In the same zone there are other large, round, deep blue nuclei situated in the center or slightly to one side of an extensive mass of branching cytoplasm which stains a light purple color. Still other smaller deeply stained nuclei show little or no protoplasm surrounding them, but these are apparently surrounded by numerous finer or coarser fibers (neuroglia-fiber stain).

The cellular elements of the "areolar areas" are mainly of two types which are separated into two zones. Within the distended network of the neuroglia tissue there are large, round or ovoid cells with a large, central or peripheral nucleus which is somewhat variable in its finer structure and staining. Some of the nuclei stain deep blue in which no definite chromatic structure can be made out; other nuclei show a light blue background with deeply stained and regularly placed blue granules. A number of the cells of this type have two and three nuclei. The cytoplasm has a definite reticulum, and in many of the cells there are large vacuoles and a large amount of light brown, stained substance—this sometimes fills the entire cell. These same elements are numerous in the adventitial spaces of the dilated vessels in the periphery of these areas. Here one observes a large number of small, round, mononuclear cells. The nuclei of these cells are deeply stained with a definite chromatic structure which stands out well because of its deeper stain.

The peripheral zone of these areas contains numerous nuclei of variable size and structure. The small, round, deeply stained nuclei

predominate; surrounding these there is but a small amount of cytoplasm; sometimes this is indicated by a delicate gray ring around the nucleus with an unstained, narrow space between it and the nucleus. However, it is shown in the preparations stained for neuroglia fibers that these nuclei are the centers of radiating fibers. The large nuclei lie in the center or periphery of a large, irregularly branched mass of protoplasm which takes on a faint purple stain; in some of these cells there are two or more nuclei and other irregular well stained bodies and here and there light brown masses. There are numerous small nuclei quite regularly distributed throughout the meshwork and situated at the nodal points of the network—around these no cytoplasm is apparent.

The “areolar zones” have a smaller number of nuclei and present a more regular distribution, situated at the nodal points of a dense network. They are largely of the smaller type and are deeply stained; the nuclei show a nuclear membrane. In the dilated meshes there are, here and there, large, round or ovoid cells with a central or peripheral nucleus of a light blue color. The cell body has a faint purple color showing a reticular structure; in some of the spaces there are irregular bodies which appear to be parts of cells of this type.

The “perivascular sievelike areas” present but few nuclei in the dense wall surrounding these open spaces. There are small, round, deeply stained nuclei with a well differentiated nuclear membrane but there is little or no cytoplasm surrounding them. In the spaces between the constituent elements of the vessel wall there are a few large, round or ovoid, nucleated elements and more or less coagulum in which there are numerous granules of light brown pigment and the remains of degenerated cells.

FURTHER CLASSIFICATION

The *Herxheimer Scharlach R.* preparations permit of a classification of the different types of areas as well as of a differentiation of stages in the development of certain areas.

1. The *areas of the first type*, or the primary sclerotic plaques, are strikingly free from red stain. The nuclei of the various types of cells are well stained by the hematoxylin counter stain, the cytoplasm of the various elements in the perivascular zone shows no red stain. In the transition zone one can distinguish a few large, irregular cells which contain fine granules that are stained bright red. There is no red stain outside of these cells.

2. The *sclerotic areas of the second type* stand out prominently. They appear under low magnification as red points throughout the microscopic field among which are irregularly scattered sharply circumscribed colorless areas. Under higher magnification it is shown

that in the three zones of these areas there are large, round or ovoid cells with large, well stained central or peripheral nuclei surrounded by a mass of bright red, densely packed clumps and fine granules. These cells are more dense in the perivascular zone, but are numerous in the peripheral zone and also in the transition zone. This type of cell is present in all of the stages of development of this type of sclerosis. The number of cells diminish from the periphery as the processes advance.

3. *In the third type of areas* in the spinal cord and in the root-zones and extramedullary roots, the red stain is entirely absent and the areas are stained deep blue because of the presence of a large number of nuclei.

The other types of areas (the areolar areas, areolar zones and sievelike areas) all have more or less red staining. The stain is largely within the large, round or ovoid cells, though there are loose, red granules in the spaces of the areolar areas. The red stained cells are more numerous in the areolar zones and in the tissue surrounding the sievelike areas.

It is opportune at this point to compare the preparations of Alzheimer's method A and C with the Herxheimer preparations. In the former, especially in the sections treated according to the method C the areas of the first type (primary lesion) present in the perivascular zone, large, irregular cells with broad protoplasmic processes. The cell protoplasm is stained green in which there are a few variable granules stained bright red. There are no red granules outside of these cells. In the peripheral reaction zone this type of cell is present in larger numbers, and the red stained granules within the green cell body are numerous. There are no other cells containing these red stained granules, and the red granules are not seen outside of the cell body.

In the second type of the sclerotic areas (secondary lesion) there appears an interesting color differentiation. In the large, round or ovoid cells so numerous in this type of area, the granules are stained a brownish-red while the granules in the large, branched protoplasmic cells are stained a bright red. The granules in the former are more regular and more dense, while the latter are fine irregularly scattered particles. The large, round or ovoid cells are densely packed around the vessel lumen. The large, branched, protoplasmic cells are found in the peripheral zones. In the other secondary types of areas similar observations are made. In the third type where neither the large, round or ovoid cells of the foregoing variety occur, there are no red stained granules.

CONCLUSION

Considering the observations in the foregoing pages and the descriptions and illustrations of other writers in which there is really no marked discrepancy except in the conclusions, it is a fair deduction to say that the various lesions in multiple sclerosis cannot be placed as successive stages in a process as a whole, which forms the characteristic sclerotic plaque. On the other hand, and on the same basis, it is possible to differentiate a series of pathologic changes which are embryologically the successive stages of three distinct processes.

Cytologically, there are three well defined types of lesions the result of one common etiology.

The first or primary lesion consists of elements derived from the ectoderm. There are embryonic cells in all stages of development in the process of neuroglia fiber formation and subsequently presenting the various steps of retrogression. The cell elements are:

1. Undifferentiated ectodermal cells.
2. Neuroglia cells showing mitosis.
3. Fiber-forming neuroglia cells.
4. Multinucleated neuroglia cells.
5. Ameboid neuroglia cells.
6. Neuroglia cells showing retrogressive changes.

The second type of lesion consists of:

I. Mesodermal elements in all stages of proliferation incident to an exudate and a destruction of the medullary substance as follows:

1. Fat granule cells and endothelioid cells of various types showing developmental and retrogressive changes.
2. Fibroblasts.
3. Lymphocytes.
4. Mononuclear and polynuclear leukocytes.
5. Plasma cells.
6. Mast cells.

II. Ectodermal elements in all stages of development in the process of neuroglia fiber formation reactionary to a biogenetic imbalance. These are:

1. Multinucleated neuroglia cells.
2. Large ameboid neuroglia cells.
3. Large protoplasmic glia cells showing steps incident to fiber formation.
4. Ectodermal cell types indicating retrogressive changes.

The third lesion consists of ectodermal elements resembling the cells of the sheath of Schwann and modifications of such types and spindle-shaped cells.

1. Undifferentiated cells.
2. Fusiform cells with blurred ends and elongated nuclei (neuroblasts).
3. Square cells with a large, round, central nucleus.
4. Elongated, club-shaped elements with long, tapering ends showing a splitting up into fine fibrils.

The changes in the nerve cells in the different areas cannot be so definitely isolated for the various lesions, but the degree of destruction and the rapidity of the process leaves certain characteristic features in the different types of areas. Binucleated ganglion cells were demonstrated in the cerebral cortex of all the cases.

In the vicinity of the primary lesion many of the ganglion cells were altered in character. The changes in the cells varied from an absence of chromatic substance in the periphery of the cell to a complete centralization with displacement of the nucleus and all stages of atrophy of the cells.

The nerve cell changes in the secondary areas present, on the whole, a different picture. The majority of the cells have lost their natural contour, the pyramidal cells are now ovoid and bulging, they are diffusely stained and there is a complete dissolution of the granules. Some of the cells are vacuolated, the nucleus is eccentric and all stages of cell atrophy are represented.

In the areas of the third type the changes in the ganglion cells are identical with those of the first type, but the alterations are not so marked. To a remarkable extent the ganglion cells are preserved in the vicinity of the areas in the gray matter of the cord. Though many cells are altered the majority are in apparently normal condition.

GENERAL CONSIDERATIONS

I. The first type, or the primary characteristic lesion *per se*, is of ectodermal origin and no other elements are originally a part of the formation of this type of sclerotic plaque. The whole process can be traced step by step from an undifferentiated cell through the different stages of cell proliferation by mitosis. The type of cell considered as the primary element can be demonstrated only in the areas of this type. They are invariably lodged in the adventitia and it is in this tissue that later the fiber proliferating cells are present in large numbers. The close relationship between the undifferentiated elements and the fiber-forming cells is evident in the character of the

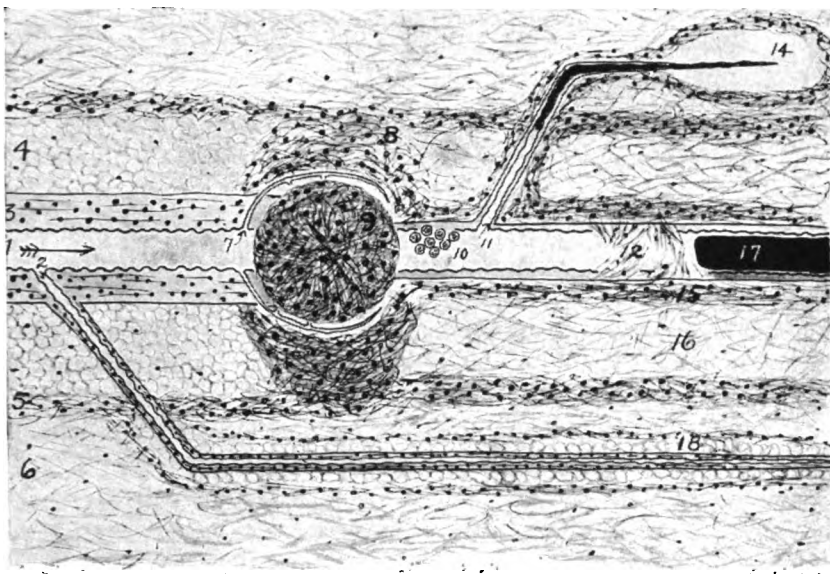


Fig. 1.—The illustration shows the relation of the primary lesion and the secondary changes in the cerebral cortex. The figure represents a blood vessel in which the primary lesion is located at (9). This consists of a mass of interwoven neuroglia fibers among which are scattered numerous neuroglia nuclei, and a section through it in any plane shows the same compact structure. It has developed from undifferentiated cells within the vessel wall. Its slow growth has gradually obliterated the lumen and the vessel wall causing secondary changes both in the proximate and distal portion of the vessel and its branches. About the tumor is a secondary neuroglia proliferation of fibers and nuclei (8). The network is less dense than that of the tumor and the arrangement of the fibers resembles that of the normal architecture. The new-formed neuroglia growth is nourished by the newly formed capillaries (7). Proximal to the primary lesion the blood vessel wall is edematous and infiltrated with small round cells, fat-granule cells, plasma cells, mast cells and transitional cells (3, perivascular zone). The tissue surrounding this zone shows a loose meshwork with wide spaces which may contain fat-granule cells and large protoplasmic neuroglia cells or many of the spaces are empty with but a remnant of an axis cylinder (4, peripheral nucleated zone). Bordering this, the neuroglia tissue shows an increased number of nuclei and the neuroglia trabeculae are thickened, the normal architecture is retained (5, transition zone). More peripheralward there is a gradual change into the normal tissue (6). A branch given off (2) proximal to the primary lesion will show the same changes, and if the branch extends some distance beyond the primary lesion these changes might occur in close proximity to the primary lesion in a cross-section at this point (18).

The distal portion of the blood vessel is obstructed: There are changes in all of the coats of the vessel wall especially the intima. A white thrombus (10) may form. The vessel may be obliterated by a thrombus (17), and proximal to this a secondary sclerosis may occur (12) which completely obliterates the vessel wall and lumen. The reaction about the blood vessel depends on the rapidity with which the vessel is occluded. Distal to the primary lesion there are two nucleated zones (15 and 5) which may be separated by a zone comparatively free from nucleated elements (16). A similar zone is seen in the tissue surrounding the proximal portion of the vessel; in this there are wide meshes and few nuclei with remnants of axis cylinders (4, "areolar (11) zone"). A terminal capillary or precapillary branch given off from the distal portion of the vessel may become blocked by a thrombus and a perivascular softening occurs with a secondary neuroglia reaction forming a dense wall about it (14, "sievelike areas").

protoplasm after cell division. In these newly formed elements, the toluidin blue stain brings out well stained, regularly placed, perinuclear granules. As the cells enlarge these granules move toward the periphery and now, light, strongly refractive lines become visible, and in the silver preparations are shown to consist of fibrils which are continuous with the striations in the protoplasmic processes of the cells. These become differentiated into fiber bundles which merge with the surrounding meshwork of similar fibers. At this point the process is limited to the vessel wall apparently extending throughout the adventitial tissue in all directions and finally surrounding the lumen as it extends to the other coats from the syncytial chain of neuroblasts which consist of fiber-forming elements in different stages of development. The difference in structure and arrangement of the newly formed tissue, clearly separates it from the surrounding tissue. Newly formed capillaries which extend into the area mark this point of separation. As the obliteration of the vessel proceeds, the surrounded nerve fibers become demyelinated and the neuroglia increases in density. The central process extends toward the periphery and infiltrates the normal neuroglia reticulum until this is obliterated and a dense homogeneous matrix is formed in which there are persistent axis cylinders. The limits of the area and the resulting secondary changes are determined by the natural conditions of the location in which it develops, that is, the structure of the tissue, the size of the vessel, its course, and whether the main stem, a smaller or a larger branch, or a terminal twig, is the site of development. The abrupt margin of the area is dependent on the limitation of the tissue in which the embryonic neuroglia cell develops. The cells do not migrate in the medullary substance and the extension of the process to the medullary substance is a fibrous penetration and a secondary proliferation of the neuroglia tissue. This is evident in the merging of the newly formed fiber bundles of protoplasmic processes with the fiber meshwork of the surrounding tissue. The primary lesion, therefore, is a new growth which has its origin in an indifferentiated embryonic cell lodged in the adventitia of a blood vessel which, under certain conditions, develops into a neuroglia fibrous tumor mass which in its course of development destroys the vessel wall and finally obliterates its lumen; at the same time new capillaries are formed in the margin of the new growth which extend into the mass of newly formed fibers. As a result of this, certain secondary changes occur. In the tissue surrounding the primary lesion there is a reaction consisting of an increased number of nucleated elements and a thickening of the normal neuroglia fiber structure.

II. The second type, or secondary lesions of multiple sclerosis, are the direct result of the gradual obliteration of a blood vessel and consist of several forms:

1. The secondary sclerotic plaque of the three zone type is formed in the distal part of the same vessel in which the primary lesion occurs. Frequently the vessel is thrombosed which is shown in cross-section. Here there is a proliferation of the cells of the adventitia and intima with the formation of new connective tissue and a perivascular proliferation of the neuroglia nuclei and fibers. The neuroglia fibers extend into the adventitia and fiber-forming neuroglia cells are here demonstrated. The connective tissue and the neuroglia fibers are shown to be interwoven. The vessel walls become gradually a dense homogeneous ring and are often obliterated by the overgrowth of neuroglia fibers forming a homogeneous matrix in which there are but a few or no persistent axis cylinders. In the process of formation there is a "fat granule cell myelitis," demyelination takes place more rapidly than in the primary lesion, and a marked compensatory neuroglia reaction occurs forming a dense network which eventually is replaced by the secondary sclerotic plaque. If the process is arrested before the perivascular neuroglia zone and the transition zone have become fused by the proliferation of the neuroglia there remain a reticulum between the two zones in the spaces of which are displaced swollen axis cylinders and portions of cells the result of degeneration. This intervening space is spoken of as the "areolar zone."

2. The "sievelike areas" are the result of small areas of softening following a thrombosis of a terminal distal branch of the vessel in which the primary lesion has occurred. Those areas are surrounded by a dense wall of neuroglia tissue, the natural result of a reaction in the neuroglia tissue. In the space thus formed there is a blood vessel or parts of the wall of a blood vessel and sometimes cellular elements and particles of tissue.

3. On the proximal side of the new growth the vessel becomes dilated and an exudate into the vessel wall and the surrounding tissue takes place. The adventitial spaces are widened and the glia meshes distended. There are wide spaces in the media. In the earlier stages of this process there are a large number of fat granule cells and a rapid destruction of the vessel wall, and the myelin in the surrounding tissue disintegrates. All the cellular elements which are ordinarily present in lesions of this type are here observed. Other areas of this type show no cellular elements the results of the exudate, and all of the spaces are empty with the exception of remnants of tissue here and there. A slight thickening of the glia trabeculae and large multinucleated glia cells in the process of fiber formation is the characteristic

microscopic picture of the "areolar areas." The latter is, in part, the result of resolution of the former infiltrated area and, in part, the result of the process of preparation. The same lesion may occur in the branches given off on the proximal side of the primary lesion.

III. It is sufficiently evident from the detailed description of the patches composed of interlacing nucleated fibers and fusiform nucleated elements that these are tumors consisting of embryonic neuronic elements.

The fact that these well-isolated nodules do not stain in the neuroglia preparations and that they appear as dark areas in the silver preparations in contrast to the characteristic light patches, differentiates them from the lesions of multiple sclerosis. The well-formed nodules are identical with the neuromas of the central nervous system. These are observed only in the spinal cord and on the nerve roots. The lymphocyte-like cells and the square cells forming definite rings around the earlier areas of this type are identical with the cells of the sheath of Schwann and the areas of this type occurring in the nerve roots are of the same structure as those in the central gray matter of the spinal cord. The type of cell, its characteristic nucleus and general morphologic structure which forms the principal element in these nodules and the syncytial neuroblast chains consisting of fibers with interstitial nuclei showing a naked axis cylinder and therefore a nerve fiber in the process of development, gives sufficient proof that these nodules are neuromas. The nodules in the extramedullary nerve roots are identical with those situated within the connective tissue septa in the spinal cord and within the connective tissue layer of the blood vessels of the central gray matter.

The undifferentiated cells (lymphocyte-like cells) occur as such in the neuromas in the primary lesion of multiple sclerosis, in syringomyelia and very similar cells in the gliomas. In syringomyelia there are in addition to the central gliosis, gliomas as well as neuromas, and direct connection can be traced between fibers of the entering posterior roots and the fibers infiltrating the intramedullary root zones. The same condition exists in multiple sclerosis, as has already been related.

The occurrence of neuromas in the nerve roots and in the spinal cord in multiple sclerosis is not an unusual incident, as both types of lesions are illustrated by other investigators though not recognized as different types of embryonic tissue, but regarded as stages in the formation of the sclerotic plaque. It is not possible to differentiate these until the cells of the syncytial chains have become fiber-forming elements, or later when this process is well advanced. The presence of neuromas in multiple sclerosis is not an accidental occurrence, but from the evidence available the origin of the primary lesion of mul-

multiple sclerosis and the neuromas is traced to the same developmental disturbance. Both forms are found in the nerve roots with chains of cells identical in both. Tumors of the same structure as those in the nerve roots occur in the spinal cord, both develop primarily in the adventitial tissue and the same cell chains are in evidence in both types. When we consider that the embryonal neurocytes are capable of differentiating to form ganglion cells, glia cells and nerve fibers and probably the nerve-fiber cells (cells of Schwann's sheath) and neuroglia-fiber cells are derived from the same mother-cell, it is readily understood how this combination is not only possible but probable. Both the neuromas of the central nervous system and the primary lesion of multiple sclerosis are derived from residues of neuroblastic tissue which becomes dislodged from the naturally developing embryonic layer of the nervous tissue, and is distributed to the various foci of development by the loose areolar tissue covering the sheaths of nerves, the epidermal tissue and the adventitial elements of the vessels of the spinal cord septa and of the pia-trabeculae of the brain.

The separated cells continue to develop in a fairly normal way to a certain point. This undifferentiated tissue remains dormant until certain pathologic conditions (hyperemia, inflammation, trauma, exposure, etc.) which disturb the biogenetic balance of the tissue, then these cells become differentiated into the various types of new formation in which the neuroblastic tissue attains full maturity, forming fully developed nerve fibers and neuroglia fibers. If the neuroblastic tissue does not develop normally some focus of undifferentiated tissues may become malignant and give rise to metastases which are represented in the areas of "neuroglia cell rosettes," usually regarded as a stage in the development of the sclerotic plaque. Such a condition occurs in the so-called acute cases of multiple sclerosis.

The elements which enter into the formation of secondary lesions, that is, the lesions caused by impeded circulation and consequent parenchymatous degeneration with secondary reaction in the supporting tissue, are identical and characteristic of such a process in other conditions. Thus, various elements which enter into the pathology of multiple sclerosis (the undifferentiated cells, tracing the development of the primary lesion from such a cell, the elimination of the stage of "fat-granule cell myelitis" from this process, the successive stages of the secondary lesions which are identical with lesions following similar circulatory disturbances in other conditions, the occurrence of the two types of lesions and the distribution of these, the presence of mitotic cell division and binucleated ganglion cells) form an unbroken chain of evidence that the primary lesion of the disease originates in embryonal neurocytes of misplaced neuroblastic tissues. The fact that

the primary lesion of multiple sclerosis is a neuroglia fiber formation, and the new growth associated with it is a nerve fiber formation supports the assumption that the sheath of Schwann cells are the fiber-forming cells, either nerve fibers or neuroglia fibers, and the displacement of the mother cell to the central nervous system by the ingrowing vessel carrying connective tissue is in accord with the findings in the cases under discussion.

(The pathologic physiology of the disease will appear later in another paper.)

PLATE 6.—PERIVASCULAR PRIMARY PLAQUE FORMATION IN SPINAL CORD

Fig. I.—Cross-section showing primary lesion in a vessel of the posterolateral septum of the spinal cord representing early stage of development. Lumen of vessel (5). Fiber forming neuroglia cell (8). Large neuroglia nucleus (15). Mitotic neuroglia (18). Van Gieson stain.

Fig. II.—Later stage from the same locality as Figure I, showing transformation of cells and neuroglia fiber formation. Lumen of vessel (5). Fibers forming neuroglia (8). Undifferentiated cell (17). Van Gieson stain.

Fig. III.—Later stage showing well developed neuroglia fiber proliferation. Fiber forming neuroglia (8). Pathologic neuroglia (10). Undifferentiated cell (17). Mitotic neuroglia (18). Van Gieson stain.

Fig. IV.—Showing well advanced fiber formation under higher magnification. Fiber forming neuroglia (8). Pathologic neuroglia (10). Undifferentiated neuroglia cell (17). Van Gieson stain.

PLATE 6

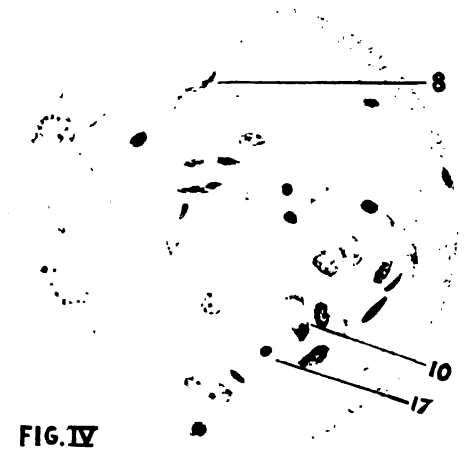
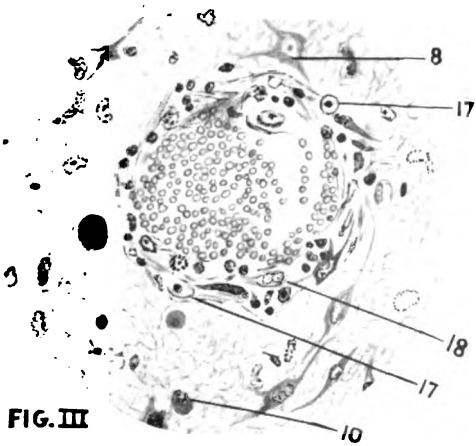
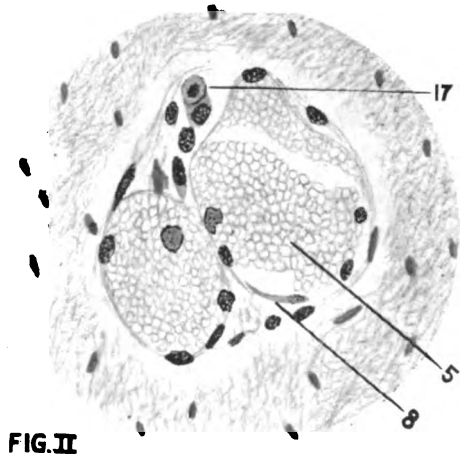
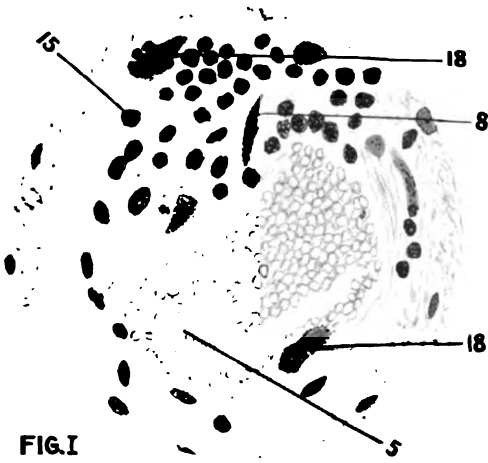


PLATE 7.—PRIMARY PLAQUES SHOWING ARRANGEMENT OF NEUROGLIA FIBERS

Fig. I.—Primary plaque from cerebral cortex showing advanced glia fiber formation. Note radiating arrangement of fibers within the plaque and reticular arrangement of glia fibers in the surrounding tissue. Axis cylinder (39). Alzheimer method.

Fig. II.—Primary plaque from cerebral cortex more advanced stage. Note the homogeneous center and the arrangement of the marginal fibers in contrast with the surrounding reticular arrangement. Pathologic neuroglia cell (10). Blood vessel (38). Van Gieson stain.

Fig. III.—Numerous primary plaques from left lenticular nucleus under lower magnification. New capillary (38). Alzheimer method.

Fig. IV.—Primary sclerotic plaques from spinal cord. Demyelinated areas (42). Neuroma (43). Bielschowsky method.

PLATE 7

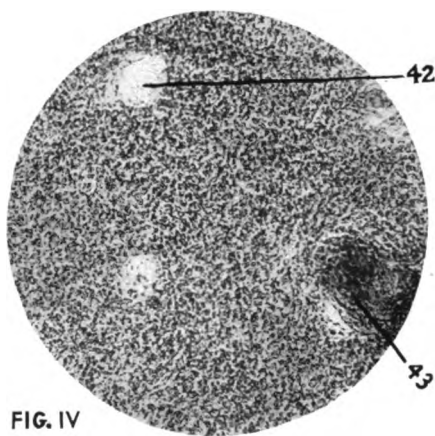
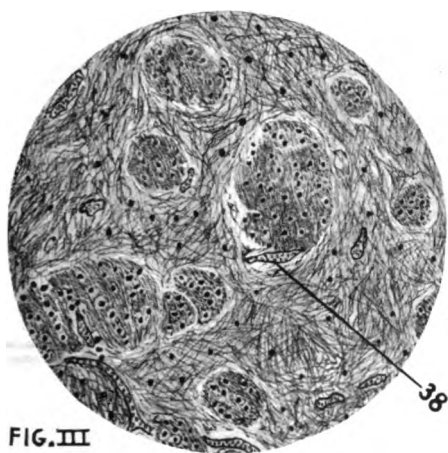
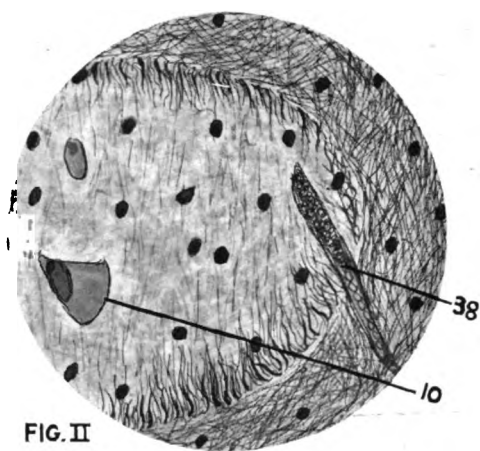
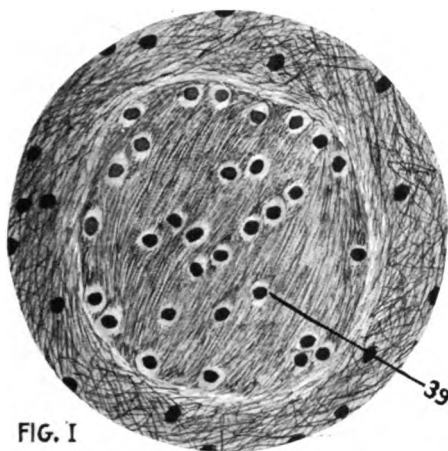


PLATE 8

Fig. I.—Blood vessel with mononuclear cell infiltration of vessel wall and perivascular tissue. Van Gieson stain.

Fig. II.—Section of a blood vessel showing demyelination and perivascular glia proliferation with connective tissue increase. (Note persistent axis cylinders and perivascular areolar zones.) Van Gieson stain.

Fig. III.—A section through the aqueduct of Sylvius near the origin of the nucleus of the trigeminus showing granular ependymitis and a primary plaque. Primary plaque (40). Granular ependyma (41). Mallory's phosphotungstic acid hematoxylin.

Fig. IV.—Cross-section of cervical cord showing a sharply circumscribed sclerosed area (23) in the posterior column with more or less diffuse sclerosis about it. Pal-Weigert stain.

PLATE 8

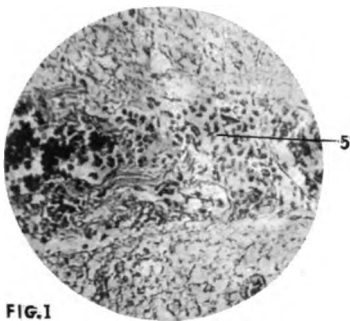


FIG. I



FIG. II

FIG. III

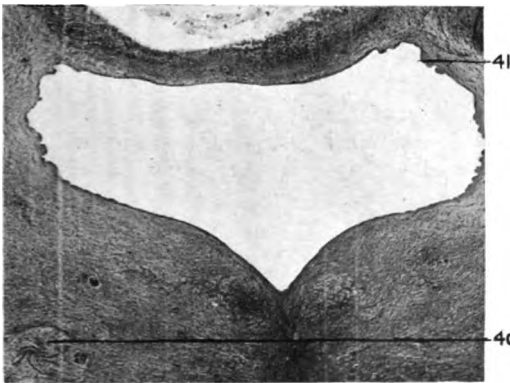


FIG. IV

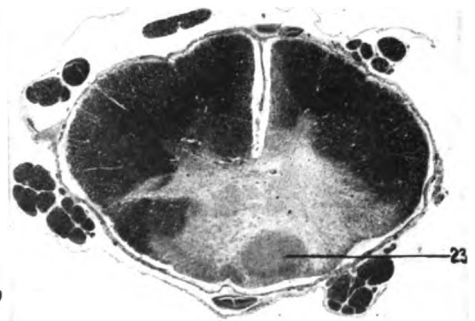


PLATE 9

Fig. I.—Section of a cortical area showing numerous engorged capillaries and large areas of demyelination. Perivascular sclerosis (42). Bielschowsky's silver impregnation.

Fig. II.—Cross-section of a cortical area showing changes in the axis cylinders in the demyelinated area and the transition zone. Bielschowsky's silver impregnation.

Fig. III.—Section of cortex showing sievelike area. Mallory's phosphotungstic acid hematoxylin.

Fig. IV.—Section of cortical area showing advanced secondary sclerosis and small areas of softening. Bielschowsky's silver impregnation.

PLATE 9

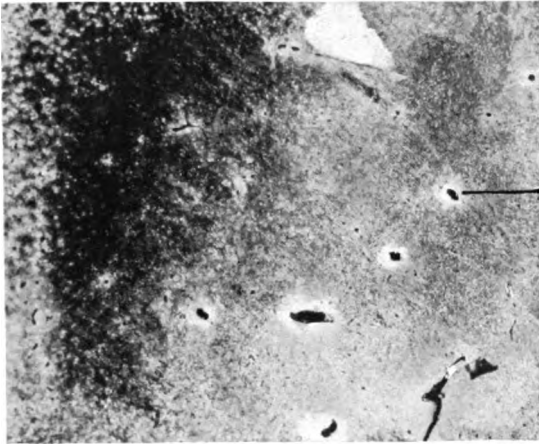


FIG. I

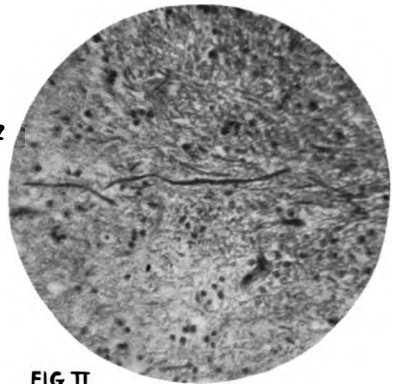


FIG. II

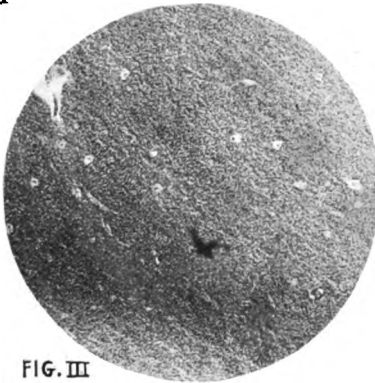


FIG. III

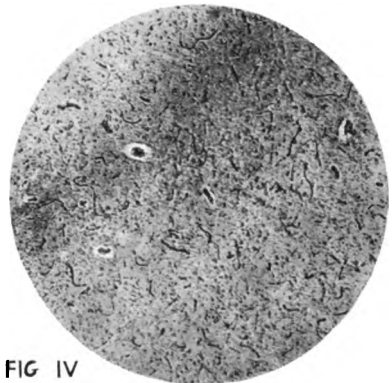


FIG. IV

PLATE 10.—A STUDY OF THE VARIOUS CELL TYPES FOUND IN MULTIPLE SCLEROSIS

(17). Undifferentiated cell showing variations in the nucleus and cytoplasm.

(10). Pathologic neuroglia cell.

(43). Ameboid and granular neuroglia cells.

(34). Embryonic type of cells from the sheath of Schwann and from areas in the spinal cord.

(118). Mitotic neuroglia cell.

(8). Fiber forming neuroglia cell.

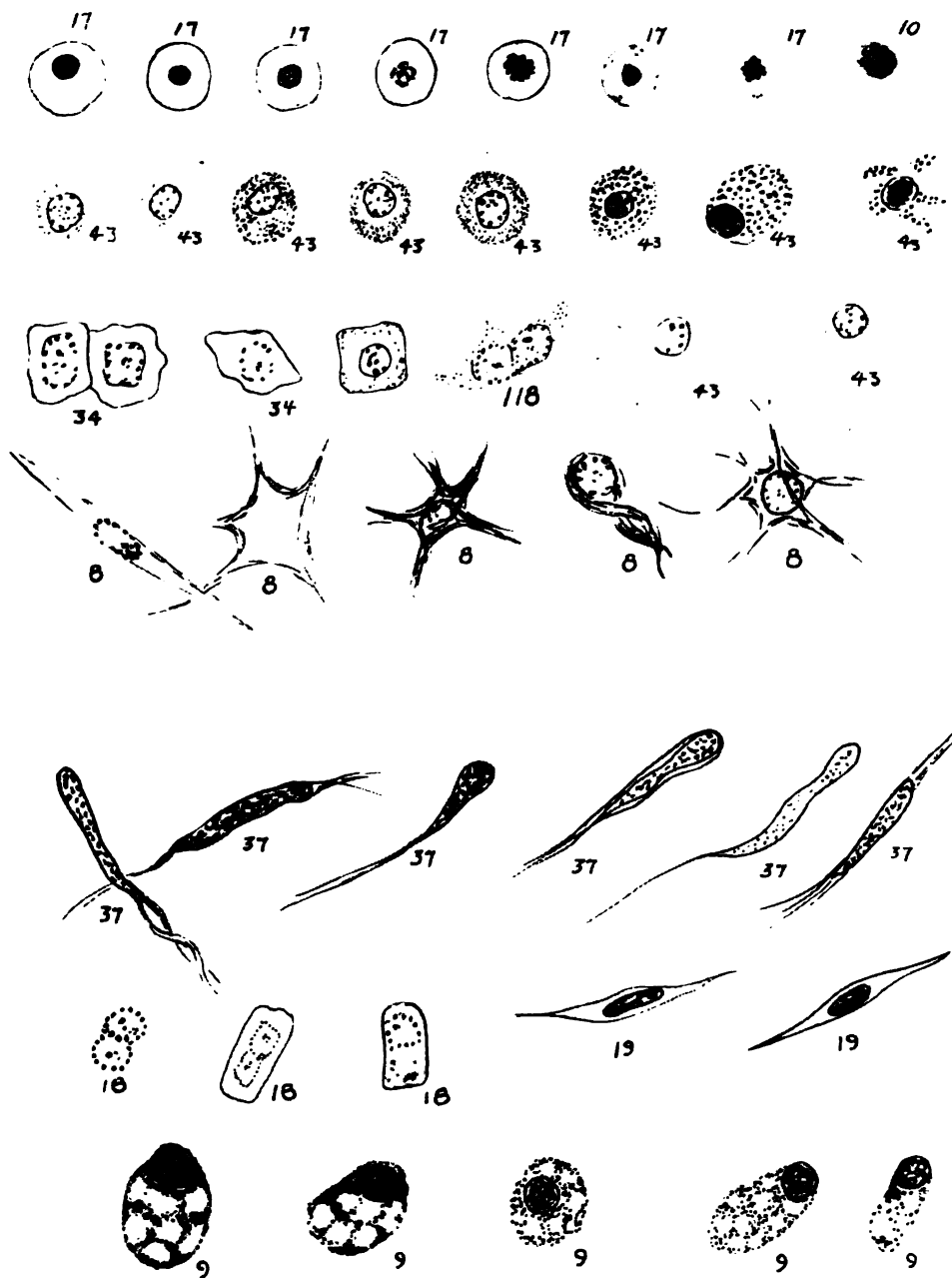
(37). Neuroblasts.

(18). Epithelioid cells.

(19). Fibroblasts.

(9). Fat granule cells.

PLATE 10



THE SUBACUTE FORM OF MULTIPLE SCLEROSIS *

WILLIAM G. SPILLER, M.D.

Professor of Neurology, University of Pennsylvania

PHILADELPHIA

In order to obtain a more correct understanding of the histology of multiple sclerosis it is necessary to examine the lesions when the course of the disease has been rapid. Cases of multiple sclerosis with necropsy are exceedingly rare in America, and therefore one in which death occurred within the second year after the onset, as it did in the case presented in this paper, should be of interest. This study permits me to conclude that, at least in some cases, multiple sclerosis may be regarded as multiple glioma. There is also a possibility that at times syphilis may play a rôle, and opportunity is taken to consider the findings justifying this point of view.

The patient who afforded the opportunity for the present study was a male, aged 25. The symptoms began in February, 1915, with headache. In June, 1915, vision began to fail. In July, 1915, optic neuritis was observed. Weakness of the limbs developed gradually, with nystagmus, incoordination, vertigo, scanning speech, intention tremor and progressive impairment of gait until walking finally became impossible and mentality very feeble. Death occurred Dec. 21, 1916.

The notes of this case are as follows:

History.—E. B., white man, aged 25, was admitted to the University Hospital of the University of Pennsylvania, July 21, 1916, and died Dec. 21, 1916. He had been well until February, 1915, when he began to have severe frontal headache. At this time he had no motor symptoms. In June, 1915, his vision began to fail. In the middle of July, 1915, he was admitted to the University Hospital on Dr. de Schweinitz's service. The diagnosis of optic neuritis was made. As vision failed the headache subsided. The sensation of twitching of the arms and legs grew worse and he became weak. He was greatly improved by one month's stay at the seashore. Since January, 1916, his condition has become steadily worse. In February, 1916, he developed ataxia of the lower limbs and vertigo, and the weakness of the lower limbs increased. His speech has become somewhat slurring, nasal, and monotonous since March, 1916. Since May he has had an intention tremor of the forearms. Since June 20, 1916, he has not been able to walk.

He has had chickenpox, whooping cough, influenza in infancy and early childhood. He denies venereal disease. His family history is negative. He does not use alcohol. He is a student in the Wharton School of the University of Pennsylvania.

* Read by title at the Annual Meeting of the American Neurological Association, May, 1917.

Examination.—The pupils are equal; irides react promptly and equally to light and in convergence. Horizontal nystagmus of large amplitude occurs when he looks to either side, and vertical nystagmus when he looks upward. Extraocular rotations are unimpaired. Facial musculature is unimpaired. Hearing of the watch tick is fair in each ear. The tongue is protruded slightly to the right of the midline without tremor and is freely movable to either side.

Extremities: Grip fair with the right hand, poor with the left. Marked ataxia and, at times, coarse intention tremor developed in both arms by finger to nose and finger to finger tests. Diadochokinesis is impaired in both forearms. Sense of position and stereognostic sense are normal in the hands. Biceps reflex is normal and equal on both sides. Triceps reflex is questionably present on both sides. Cremasteric reflex is prompt on the left side, sluggish on the right. Patellar reflex is slightly exaggerated on the right side, normal on the left. Achilles reflex is moderate on both sides and equal. Plantar stimulation induces plantar flexion on the left side, dorsal flexion on the right side. Ankle clonus was obtained on the right side at the first examination, but could not be elicited on either side at the second examination. Heel to knee test shows marked ataxia on both sides. Both legs show slight spasticity. Legs and trunk are weak and probably ataxic. The man cannot stand or even sit up unsupported. Sensations of touch and pain are normal throughout. Slight coolness is mistaken for warmth in the right calf. Otherwise objective sensation is unimpaired.

The voice is slow, monotonous, thick and somewhat slurring. The laugh is deep, expressionless, almost spastic, not unlike the laugh of Wilson's disease. The lower limbs are very weak. There is more power in extension than in flexion. There are frequent brief rapid changes in the amount of power in all the movements of the extremities. He passpoints outward with both hands spontaneously.

July 25, 1916: (Ocular report by Dr. Langdon.) O. D., vision 6/15; O. S., 6/45. Both disks show decided loss of capillarity, well defined central cups and sharply defined margins. There are no other fundus changes.

July 22, 1916: Blood: Red blood cells, 5,160,000; white blood cells, 8,400; hemoglobin, 80; polymorphonuclears, 78; lymphocytes, 19; large mononuclears, 1; transitionals, 1; eosinophils, 1; basophils, 1. Urine analysis: Cloudy, amber-colored; flocculent sediment; specific gravity, 1.025; acid reaction; albumen, none; sugar, none; casts, no cylindroids; mucus, plus; no red blood cells; white blood cells, occasionally present; epithelium was present, also calcium oxalate crystals.

July 28, 1916: Lungs are negative except for slightly increased vocal fremitus over the right upper lobe. Heart is negative except for slightly accentuated pulmonic second sound.

Sept. 18, 1916 (ocular report dictated by Dr. Shumway): There is a marked pallor of the temporal half of the optic nerve on each side and paralysis of the right internal rectus.

Oct. 10, 1916: Patient is somewhat delirious. Wassermann test of the blood has been taken several times in the hospital and was always negative. The patient's father states that the blood taken outside the hospital for the Wassermann test he thinks was positive. Owing to certain circumstances a lumbar puncture was not done.

Oct. 13, 1916: The patient is not able to take care of himself and lies in bed except when moved in a wheeling chair. He has marked ataxia, scanning

speech, nystagmus and intention tremor. His mentality has gradually failed and is now greatly impaired.

Dec. 21, 1916: This morning the patient's temperature, pulse and respiration suddenly went up above normal and he could not be aroused. He had been without change in his condition on retiring the night before. His heart was fast and irregular. At 8 a. m. on this date he was still unconscious and his breathing was difficult and irregular, and, while still fast, there was no increased area of cardiac dulness.

Postmortem Examination (Dec. 21, 1916).—The postmortem examination revealed practically nothing abnormal with the viscera. The areas of sclerosis are very numerous and are found in every section taken from the spinal cord, but they are more pronounced in the cervical and lumbar regions than in the thoracic. These areas are in some places fairly sharply defined from the normal tissue, but in many places the shading off into normal tissue is observed. Lacelike structure is found in some of the patches. The areas are infiltrated with numerous mononuclear cells, and these are especially numerous about the blood vessels within the cord and in some of the septa running into the cord. These cells are very numerous in both the pia of the cord and brain, and in some places form dense masses. The large spider cells (Deiters' cells) so numerous in the foci within the cerebrum, are not found in the cord.

The alteration in the medulla oblongata is as intense as in the cord. The Marchi sections of the cord and brain show intense recent degeneration except in areas of long standing in the cord. The nerve cells of the anterior horns of the cervical and lumbar regions are well preserved even in sclerotic foci, as shown in the thionin stain, and do not show pigmentary degeneration, although occasionally a cell showing chromatolysis and swelling may be found.

The optic chiasm, tracts and nerves are greatly degenerated and show much infiltration with cells of mononuclear type. Some foci of degeneration are found in the cerebellum, as in the right dentate nucleus.

Sections from many parts of the cerebrum show disappearance of medullary substance in the altered areas. The sharpness of definition of the degenerated from the normal tissue is possibly even more pronounced here than in the spinal cord. The nerve cells in the altered cortex are well preserved. The cerebral foci contain many large glia cells (Deiters' cells), mononuclear cells and fatty granular cells, and these foci differ greatly from the foci of the spinal cord in that the former are almost entirely cellular. These areas look like so many distinct gliomas, and while they appear under low power to be sharply defined, under high power scattered glia cells may be seen penetrating into the adjacent tissue like scouts of an invading army.

There have been few cases of multiple sclerosis with necropsy reported in this country — a statement also made by Taylor — and the study of this disease must be made chiefly from the foreign literature. There we find cases in which the brain has been seriously affected by the lesions, but in most cases the description has been based on the study of the spinal cord. In this case of subacute multiple sclerosis recently under my care every section taken from any part of the cerebrum shows foci with lesions peculiar to this disease. The alteration in the cerebrum is very different from that in the spinal cord, and my findings confirm the statement of Marburg, namely, that cellular

proliferation of glia is greater in the brain than in the spinal cord, and that the large glia cells are found more in the brain than in the spinal cord.

The glia proliferation of the spinal cord is in large measure of the character of the overgrowth of glia seen in the replacement of nerve fibers from secondary degeneration caused by some lesion at a higher level; it is therefore chiefly fibrillar. In the cerebrum the glia proliferation is of a different character, it is chiefly cellular and is more recent than that of the cord. Mental failure usually does not precede the other symptoms of multiple sclerosis, it occurs later in the disease

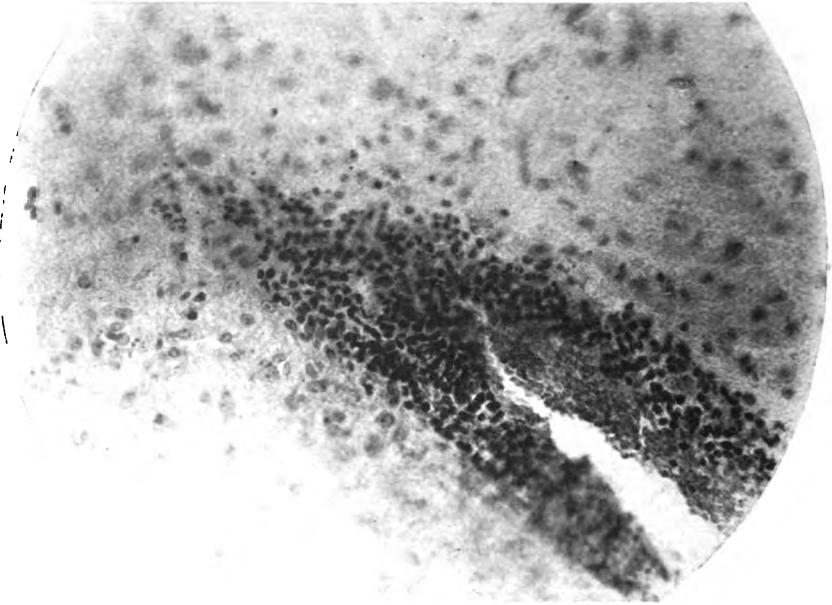


Fig. 1.—Vessel in the left paracentral lobule surrounded by many cells of mononuclear type.*

and the lesions producing it must be of late development. In this case the mental failure became pronounced and it is to be explained by the extensive alteration of the cerebrum. If one, therefore, desires to find the earlier changes of multiple sclerosis he should look for them in the cerebrum. The lesions are usually less numerous in the cerebellum.

The changes in the cerebrum in the case recorded in this paper were in overgrowth of the glia causing a microscopic picture resembling that of a glioma. Indeed, my studies of these sections lead me

* I am indebted to Dr. A. J. Smith for the photomicrographs.

to conclude that multiple sclerosis may be a process consisting of innumerable minute gliomas, although other types possibly may occur. It is no wonder, therefore, that the mentality of my patient became exceedingly feeble. The cellular infiltration of mononuclear type within the tissue about the vessels has been noted in many cases of multiple sclerosis, but it may be found also in glioma. The large glia cells, spider cells or Deiters' cells, I have found only in the brain, and they are indicative of chronic irritation. I have seen them in the spinal cord when the cord was severely distorted by the pressure

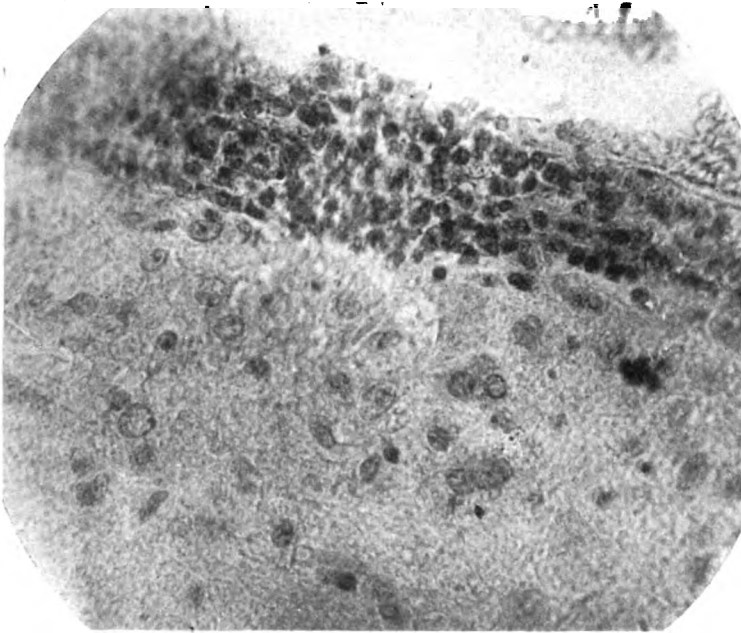


Fig. 2.—Part of the vessel shown in Figure 1 under higher magnification. Beyond the mononuclear cells are seen numerous other cells, some of which are glia cells.

of an extramedullary tumor, but I have not observed them to the same degree in syphilitic encephalitis.

The relation of the foci to blood vessels has been asserted by some investigators, disputed by others—I have not been able to establish it. About one vessel within the brain many mononuclear cells were found and beyond these were other cells, some of which evidently were glia cells. It seems as though some irritative substance either within the vessel or the perivascular sheath may have caused this proliferation (Fig. 2).

Wohlwill made a very thorough digest of the literature of multiple sclerosis for the ten years ending April, 1913. He says the definition of multiple sclerosis is made to include different lesions by different writers. From a pathologic viewpoint he defines the condition as the occurrence of circumscribed foci in the central nervous system in which the medullary sheaths have disappeared or are disappearing, the axis cylinders and ganglion cells are relatively intact, and a more or less intense glia proliferation exists without displacement of the adjoining nervous tissue. Siemerling and Raecke have stated that in those cases in which the cerebral cortex is implicated the cortex is the

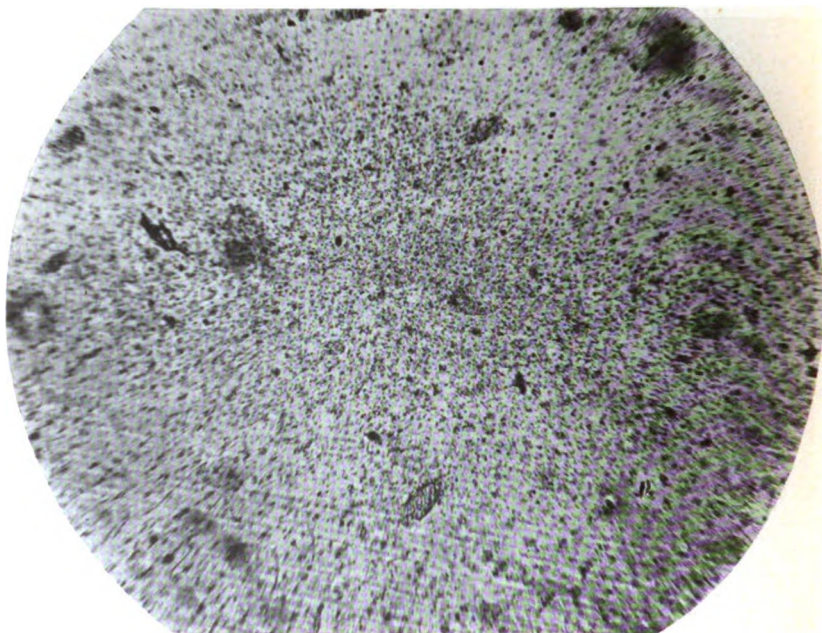


Fig. 3.—A mass of proliferated glia cells included entirely within a low magnification, showing the small size of some of the altered cerebral areas.

chief seat of the lesions, but my examination in this case does not support this statement. Cases with great preponderance of cortical involvement he states have been reported by Dinkler, Fuller, Klopp and Jordan.

The most recent comprehensive work on multiple sclerosis has been done by James W. Dawson. He states that the etiology of the disease remains absolutely obscure. The supposition of a selective poison acting through the blood vessels, which has received the support of most recent investigators, is justified as an hypothesis, but remains undemonstrated as a fact. Dawson devotes special attention to the

early changes of the disease, and he states that our knowledge of the histology, especially of the early stages, has not kept pace with our recognition of the early clinical aspects of the disease. Experimental investigation, Dawson says, has proved only that disseminated areas of myelitis may result in a reparative growth of neuroglia, but it has not proved that area of typical disseminated sclerosis proceed from an acute myelitis.

I am unable to accept the view that multiple sclerosis is caused alone by some irritant circulated by the blood, but it seems to me

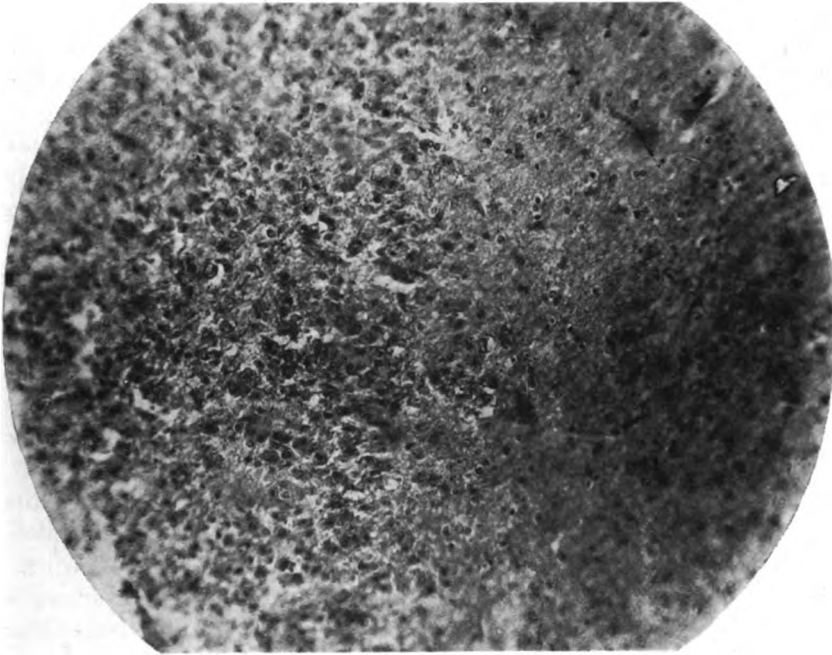


Fig. 4.—One of the cerebral sclerotic areas consisting largely of glia cells, under higher magnification than that represented in Fig. 3. The sharp definition of normal from altered tissue runs almost through the middle of the photograph. Mallory's neuroglia stain.

probable that such an irritant acting on tissue in which the disease is latent may hasten its development.

Dawson asserts that a study of the cerebrospinal fluid in multiple sclerosis has as yet thrown little light on the disease, but investigations along this line have not been extensive.

In the report of a case of multiple sclerosis he states that the "early" areas in the cerebrum consisted largely of closely arranged fatty granular cells between which were large protoplasmic, proliferated glia elements; of dilated vessels, with fatty granular cells and

other nucleated elements in their adventitial spaces; of markedly altered persisting axis cylinders; and of a gradual transition zone in which these changes were less marked and in which degenerating myelin fibers were found. These findings describe very accurately those in my case.

Dawson found the cerebral and spinal meninges almost normal in his uncomplicated cases; meningeal changes when present were diffuse and in no way confined to the meninges overlying areas of sclerosis.

As for syphilis, he says it has no significance in the etiology. Syphilis may produce disseminated areas in the central nervous system, but the histologic character of these have, as a rule, nothing in common with those of disseminated sclerosis, in which disease also the reactions of the serum and cerebrospinal fluid and the cytologic examination of the spinal fluid are all negative.

The cellular infiltration of mononuclear type in the cerebral pia in my case is a finding of considerable interest. It is exceedingly pronounced and suggests the findings of syphilis. Unfortunately, a lumbar puncture in this case was prevented by certain circumstances, but a Wassermann test of the blood done outside the hospital was supposed to be positive.

When working in Obersteiner's laboratory in 1893 and 1894, I found in a case of multiple sclerosis cell infiltration of mononuclear variety of considerable intensity about the blood vessels of the cord and within the spinal pia. This finding is referred to by Bikeles in his paper published in 1895.

Wohlwill, in his critical digest on multiple sclerosis, speaks of the frequency of the perivascular cellular infiltration, but says polymorphonuclear cells do not occur in the infiltration. The infiltration consists of lymphocytes, plasma cells, some mast cells and fatty granular cells. Plasma cells are not always present. The cellular infiltration usually does not extend beyond the perivascular limiting layer of glia, although lymphocytes occasionally are found within the degenerated focus.

The meninges he states frequently are thickened and may show cellular infiltration, consisting of lymphocytes, plasma and mast cells, endothelial and connective tissue cells, and the vessels may show similar changes to those of the vessels within the foci. The cellular infiltration about the vessels of the pia he states is described by Flatau and Kölichen.

Marburg in his paper on acute multiple sclerosis stated that the meninges in acute multiple sclerosis had not received so much attention as they deserve. In one case only he found meningeal changes. Cellular infiltration was chiefly with connective tissue cells, but also with endothelial cells from the vessels, mast cells, plasma cells and

lymphocytes, but the picture he gives does not show anything like the intensity of cellular infiltration seen in my case.

Rönne and Wimmer found in a case of acute multiple sclerosis pronounced cellular infiltration of the tissue, either diffuse or in little clumps, especially about a vessel or within its walls. The cells were mononuclear and polynuclear leukocytes, fatty granular cells, plasma cells and *Stäbchenzellen*. They found no evidence of spinal meningitis. They give much evidence justifying the opinion of multiple sclerosis as a myelitis—an inflammatory process.

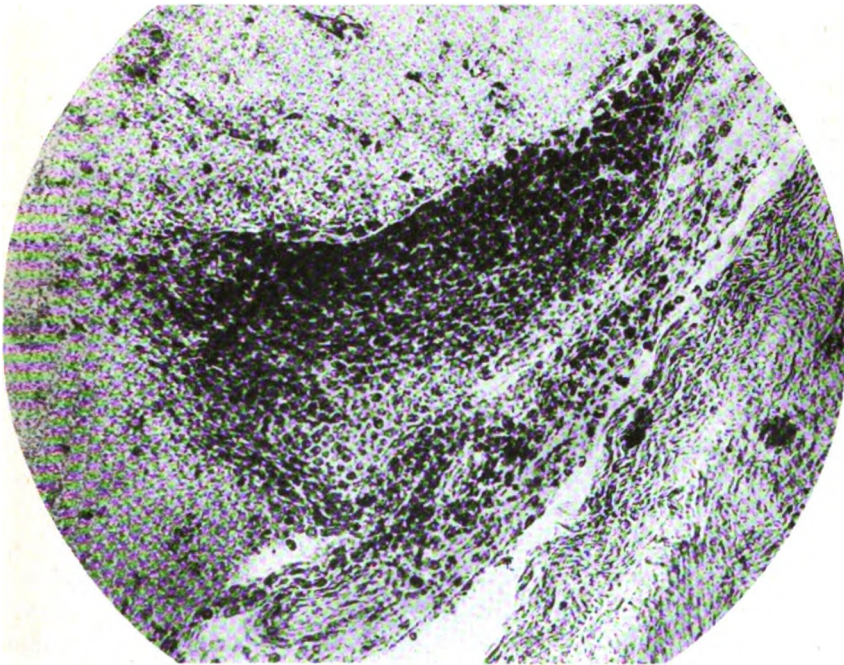


Fig. 5.—Large collection of mononuclear cells in the pia of the left paracentral lobule, suggesting the finding of syphilis.

In a case of multiple sclerosis described by Finkelnburg the vessels in the foci were much distended and surrounded by broad masses of mononuclear cells, and in some places these cells hid the vessel walls, and in some places the tissue surrounding the vessels was infiltrated with the round cells, but there was no sign of meningitis. He found an infiltrated vessel in the midst of a focus, as a rule, and he states that in his case, as in Ribbert's and Goldscheider's, an infiltrated vessel was found in the center of most of the small foci. Finkelnburg found many vessels infiltrated with round cells that were not in sclerotic foci.

The case reported by Barbier and Gassier was in a child 5 years of

age, in whom the Wassermann reaction was positive, and the symptoms these authors thought could be attributed only to multiple sclerosis. Much improvement occurred in the child's condition. The case was without necropsy and is not altogether convincing, and does not prove that the condition was caused by syphilis.

Dr. Joseph McIver at my request has examined the fluid obtained by lumbar puncture from a typical case of multiple sclerosis of a few years' duration. He found 200 cells to the cubic millimeter, mostly mononuclear. An accident prevented a Wassermann examination of this fluid.

In 1909, I reported with Dr. Andrew H. Woods a case in which the symptom complex was one of spastic paraplegia of the lower limbs with contracture of the limbs, and pain produced by passive movement of these limbs, probably because of the contractures; exaggeration of tendon reflexes in both upper and lower limbs, although the reflexes could not be well demonstrated in the latter because of the position of these limbs; and loss of control of bladder and rectum, with preservation of objective sensation. These symptoms could be caused by multiple sclerosis.

Numerous areas of sclerosis were found throughout the cervical and upper thoracic regions of the cord, some of which resembled closely the degenerated areas found in multiple sclerosis. Slight cellular infiltration of mononuclear type in the pia, the gradually shading off of the sclerotic areas into the normal tissue instead of the sharp line of differentiation; the vascular and perivascular sclerosis in regions of the cord where there was no distinct focus of sclerosis, seemed to us to indicate that the process was syphilitic. I feel less sure of the correctness of this viewpoint at the present time, and am almost willing to accept Catola's opinion that the distinction between the different forms of multiple sclerosis are unreliable and that syphilis cannot be eliminated as a cause. It is well to recall the view of Orlowsky, and Thomas and Long, that syphilis and multiple sclerosis have occurred in the same person.

Wohlwill states that the pathologic distinction between multiple sclerosis and the multiple lesions of syphilis in many cases is not simple. The syphilitic lesions may be very similar. Barbier and Gassier try to establish a relation between certain cases of multiple sclerosis of childhood and congenital syphilis. Marburg has stated that he has found multiple sclerosis strikingly frequent in the descendants of syphilitic parents, even when the patients presented no evidence of syphilis. Statistics have not shown that syphilis is frequent in the history of multiple sclerosis cases. Berger found it only in 1.5 per cent. of the cases, Klausner in about 3 per cent. Hauptmann in

a comparatively short time found four cases of multiple sclerosis with syphilitic history.

Catola states that in certain cases syphilis is the only malady which seems to play a rôle in the etiology of multiple sclerosis, and refers to Babinski, Greiff, Orlowsky, Thomas and Long, and Wernicke, but concludes that the relation of syphilis to multiple sclerosis is far from being determined.

In the first case of Catola's paper the patient is said to have been syphilitic and had disseminated lesions which Catola regarded as like those of multiple sclerosis. The spinal pia was infiltrated by lympho-

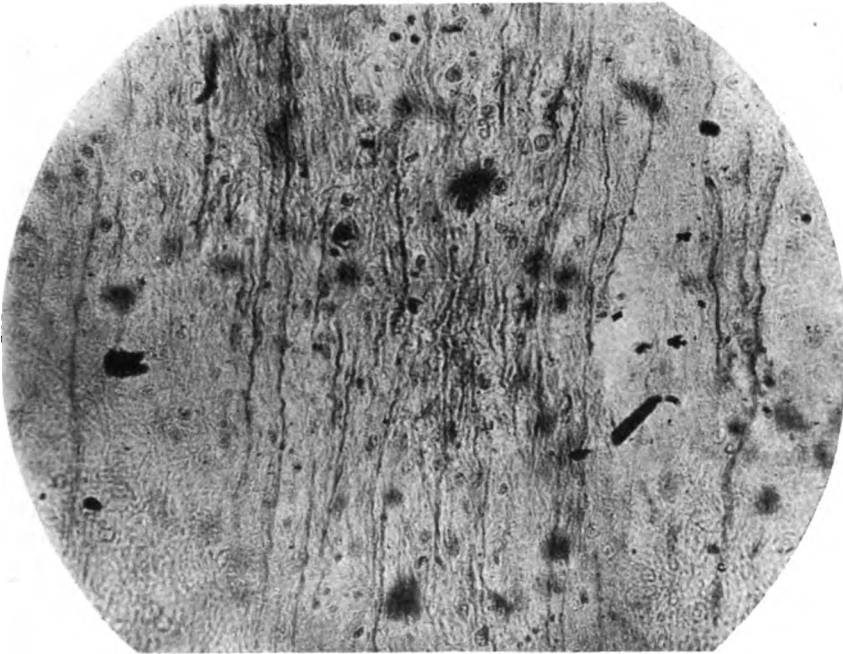


Fig. 6.—Naked axis cylinders (Bielschowsky stain) in a sclerotic area of the spinal cord, showing the presence of these axis cylinders in apparently completely degenerated tissue.

cytes and polynuclear cells, and the infiltration was especially intense in the posterior longitudinal septum. The photographs represent an intense cellular infiltration of the pia. The polynuclear cells were found almost exclusively in the lower part of the cord and were attributed to infection from a bedsore. Catola concludes that syphilis may be very important in multiple sclerosis, and there is a syphilitic multiple sclerosis like a multiple sclerosis of any other infectious origin.

It seems probable that syphilis has some influence over multiple sclerosis. The typical lesions probably are not syphilitic in character, but the syphilis may be an *agent provocateur*. It would be well to treat early cases of multiple sclerosis as possibly syphilitic—the therapeutic test is well worthy of trial.

REFERENCES

- Taylor: J. Nerv. & Ment. Dis., p. 361, 1906.
 Marburg: Lewandowsky's Handbuch der Neurologie.
 Dawson, J. W.: Edinburgh M. J. **17**: 1916; later publication also in Rev. Neurol and Psych.
 Bikeles: Obersteiner's Arbeiten, **3**: 1895.
 Wohlwill: Ztschr. f. d. gesamt. Neurol. u. Psych., Referate und Ergebnisse. **7**:849, 1913; Neurol. Centralbl. p. 732, 1912.
 Marburg: Jahrb. f. Psych. **27**:211, 1906.
 Rönne and Wimmer: Deutsch. Ztschr. f. Nervenhe. **46**:56, 1912.
 Finkelnburg: Deutsch. Ztschr. f. Nervenhe. **20**:418, 1901.
 Barbier and Gassier: Bull. Soc. de pédiat. de Paris p. 14, 1912.
 Spiller and Woods: Interstate M. J. **16**: 1909.
 Orlowsky: Neurol. Centralbl. 1897.
 Thomas and Long: Compt. rend. Soc. de biol. 1899.
 Catola: Nouv. iconog. de la Salpêtrière **19**:337, 1906.
 Barbier and Gassier: Bull. Soc. de pediat. de Paris p. 9, 1912.
 Hauptmann, A.: München. med. Wchnschr. **57**:1581, 1910.
 Kuhn and Steiner (Med. Klin., No. 37, 1917), by inoculating rabbits and guinea-pigs with blood and cerebrospinal fluid from cases of multiple sclerosis produced paralysis and found spirochetes within the vessels of the liver of the inoculated animals.
 Siemerling (Berl. klin. Wchnschr., No. 12, 1918) discovered living spirochetes in the sclerotic foci of multiple sclerosis.
 Strümpell (Neurol. Centralbl., No. 12, 1918) urges caution in the interpretation of these findings.

UNSUSPECTED INVOLVEMENT OF THE CENTRAL NERVOUS SYSTEM IN SYPHILIS

A STUDY OF SIX HUNDRED AND TWENTY-FOUR UNSELECTED CASES *

P. FILDES, M.B.

Hon. Surgeon Lieutenant Commander, R.N.V.R., working on behalf of the
Medical Research Committee

R. J. G. PARNELL, L.R.C.P.

Surgeon Lieutenant Commander, R.N.

AND

H. B. MAITLAND, M.B.

Temp. Surgeon Lieutenant, R.N.

HASLAR, ENGLAND

Within recent years it has been gradually established that syphilis in the early stages may cause marked lesions of the central nervous system, but it has been more slowly realized that it may also produce definite involvement of the central nervous system without necessarily causing any symptoms.

Since 1903, when a series of papers by Ravaut¹ appeared, much interest has been shown in the study of this phase of the disease. Ravaut examined the cerebrospinal fluid of 100 cases of early secondary syphilis, and found pleocytosis and other pathologic changes in many. In fact, only twenty-eight could be said to be normal. Other similar observations made on small series of cases were reported by Boas and Lind,² Zaloziecki and Frühwald,³ and Bergl and Klausner.⁴

In 1913, Altmann and Dreyfus⁵ published the results of the exam-

* From the Venereal Section and Laboratory, Royal Naval Hospital.

* This subject is discussed in greater detail in a paper by the same authors entitled "The Occurrence of Unsuspected Involvement of the Central Nervous System in Unselected Cases of Syphilis," *Brain*, Lond. **41**:255, 1918.

1. Ravaut, P.: *Le Liquide Céphalorachidien des Syphilitiques en Période Secondaire*, Bull. et mém. de la Soc. méd. d. Hôp. de Par. **20**:1026, 1903.

2. Boas, H., and Lind, H.: *Untersuchungen der Spinalflüssigkeit bei Syphilis ohne Nervensymptome*, Ztschr. f. d. ges. Neurol. u. Psychiat., O. **4**:6, 1911.

3. Zaloziecki, A., and Frühwald, R.: *Zur Kenntnis der Hirnnervenstörungen im Frühstadium der Syphilis*, Speziall nach Salvarsan, Wien klin. Wchnschr. **25**:1162, 1912.

4. Bergl, K., and Klausner, E.: *Ueber das Verhalten des Liquor Cerebrospinalis bei Luetikern*, Prag. med. Wchnschr. **37**:467, 1912.

5. Altmann, K., and Dreyfus, G.: *Salvarsan und Liquor Cerebrospinalis bei Frühsyphilis, nebst Ergänzenden Liquoruntersuchungen in der Latenzzeit*, München. med. Wchnschr. **60**:464 and 531, 1913.

ination of the cerebrospinal fluid in 170 cases, which included all stages of syphilis. They found in the "secondary stage with chancre," 5 abnormal out of 21; in the "secondary stage without chancre," 21 abnormal out of 35; and in the "latent stage," 10 out of 19 were abnormal. These fluids all had over 15 cells per cubic millimeter, and some gave a positive Wassermann reaction. They also showed that the abnormalities could be reduced by arsphenamin treatment.

In the same year Ellis and Swift⁶ and Gamper and Skutezky⁷ reported similar findings, while Engman, Buhman, Gorham and Davis⁸ appear to have been the first to make a routine examination of unselected cases. Wile and Stokes⁹ also made routine examinations of all syphilitics and laid special emphasis on their observations that impaired bone conduction and "neuroretinitis" were usually present when the cerebrospinal fluid was abnormal. Of six cases of primary syphilis they found "neuroretinitis" in five, but did not discuss their findings in detail. In 1914, Hauptmann,¹⁰ Leopold,¹¹ Gutmann,¹² and Audry and Lavau¹³ may be added to the list of those who placed on record that cerebrospinal fluid abnormalities do occur in cases of early syphilis.

RECENT INVESTIGATIONS

The most recent and extensive paper on the subject was written by With¹⁴ in 1916 and published two years later. In his series of 316 cases of syphilis of all stages, twenty-six, or 12 per cent., had a

6. Ellis, A. W. M., and Swift, H. F.: *The Cerebrospinal Fluid in Syphilis*, J. Exper. Med. **18**:162, 1913.

7. Gamper, E., and Skutezky, K.: *Liquorstudien bei Syphilis*, Wien. med. Wchnschr. **63**:2410, 1913.

8. Engman, M. F., Buhman, R., Gorham, F. D., and Davis, R. H.: *A Study of the Spinal Fluid in One Hundred Cases of Syphilis*, J. A. M. A. **61**:735 (Sept. 6), 1913.

9. Wile, U. J., and Stokes, J. H.: *A Study of the Spinal Fluid with Reference to Involvement of the Nervous System in Secondary Syphilis*, J. Cutan. Dis. **32**:607, 1914. *Ibid.*, *Involvement of the Nervous System During the Primary Stage of Syphilis*, J. A. M. A. **64**:979 (March 20), 1915. *Ibid.*, *Further Studies on the Spinal Fluid with Reference to the Involvement of the Nervous System in Early Syphilis*, J. A. M. A. **64**:1465 (May 1), 1915.

10. Hauptmann, A.: *Die Diagnose der "Früh-Luetischen Meningitis" aus dem Liquorbefund*, Deutsch Ztschr. f. Nervenhe. **51**:314, 1914.

11. Leopold, O.: *Ueber Nervensymptome bei Frischer Syphilis*, Arch. f. Dermat. u. Syph. **120**:101, 1914.

12. Gutmann, C.: *Liquorbefunde bei unbehandelter Frühsyphilis*, Dermat. Wchnschr. **58**:705, 1914.

13. Audry, Ch., and Lavau: *Sur les Méninigites Preroséliques*, Ann. de dermat et de Syph. **5**:29, 1914-1915.

14. With, C.: *Studies on the Different Reactions (Lymphocytosis, Bisgaard, Ross-Jones and Wassermann) in the Cerebro-Spinal Fluid in Cases of Syphilis*, Brain, Lond. **40**:403, 1918.

pathologic increase of cells (10 or over) in the cerebrospinal fluid. Of these, 134 with rashes when examined from three to five months after infection showed 10 per cent. with abnormal cell count. It is not quite certain to what extent this series is unselected; and as there is no clinical description of the cases it is difficult to satisfy oneself regarding the one instance quoted of a case of primary syphilis which had a slight positive Wassermann reaction in the cerebrospinal fluid. The fluid contained no cells and the serum Wassermann was negative. It is thus evident that among syphilitics, particularly those in the early stages of the disease, there is a considerable percentage who have definitely pathologic changes in the central nervous system, and others with fluids less abnormal, who may be said to have doubtful changes. Indeed, this is as one would expect, for as Lang stated in 1881, "an organ which is the seat of a gummatous lesion must have been affected in the early period of syphilis."

McIntosh and Fildes¹⁵ also pointed out in 1914, that the late central nervous system disease of syphilis might well be due to an invasion of spirochetes in the early stages, and argued that a tertiary syphilitic lesion was due to a recrudescence in a remnant of spirochetes which had remained dormant *in situ* since the generalization during the acute stage.

Obviously this matter has a most important bearing on the treatment of syphilis. If all cases of locomotor ataxia dementia paralytica are preceded by early involvement of the central nervous system which causes no symptoms, it is most important that they should be discovered as early as possible. It was with a view to determine the incidence of such involvement in the various stages of the disease, to observe the effect of treatment, and to discover if such cases require special treatment that this work was undertaken.

NATURE AND CLASSIFICATION OF CASES

We wish it to be distinctly understood that this series consists entirely of unselected cases, and is composed of men who were admitted in the ordinary way to the venereal section of this hospital. It does not include any instances of frank nervous disease which would have been admitted to the neurological section. We have made it so, that our results might be taken as typical of any similar collection of cases elsewhere.

For the purposes of the investigation we have divided our cases into six divisions and have abandoned the conception of primary,

15. McIntosh, J., and Fildes, P.: A Comparison of the Lesions of Syphilis and Parasyphilis, Together with Evidence in Favor of the Identity of These Two Conditions, *Brain*, Lond. **37**:141, 1914.

secondary and tertiary stages because syphilis is a progressive disease, the organisms become generalized soon after inoculation, and the various "stages" are inconstant and merge one into the other. The classification adopted is as follows:

CLASSIFICATIONS ADOPTED FOR PURPOSES OF STUDY

DIVISION 1: Cases diagnosed by finding *S. pallida* in an inoculation lesion, before the Wassermann reaction had become positive.

DIVISION 2: Cases with a positive Wassermann reaction which had as yet shown no signs of generalized infection other than glandular enlargement, up to and including twenty-six weeks from infection.

DIVISION 3: Cases with evidences or definite history of general infection (rash, etc.) up to and including eleven weeks from infection.

DIVISION 4: Cases similar to Division 3 but from twelve to twenty-six weeks, inclusive, from infection.

DIVISION 5: Cases with active lesions of syphilis over twenty-six weeks from infection.

DIVISION 6: Cases which had no active signs of syphilis over twenty-six weeks from infection.

In every case except two in our series, excluding Division 1, the Wassermann reaction in the serum was positive.

TECHNIC AND METHODS OF EXAMINATION

For the Wassermann reaction the cholesterinized alcoholic heart extract antigen of Fildes and McIntosh¹⁶ was used throughout. The amount of serum used was 0.1 c.c. with amounts of reagents corresponding to 0.5 c.c. of a 5 per cent. suspension of sedimented sheep's blood cells.

The test as applied to the cerebrospinal fluid was done quantitatively in four tubes, the amounts of fluid used being 0.8, 0.2, 0.05, and 0.012 c.c. The fluid was *inactivated* at 56 C. for thirty minutes, the same as the serum. The reason for inactivating the cerebrospinal fluid was that such large quantities of it were used. It has been shown^{16, 17} that there is a difference between the Wassermann reaction in the cerebrospinal fluid from dementia paralytica, and that in the fluid from a case of acute syphilitic meningitis. The reacting substances in the former are more thermostable than in the latter, and it has been suggested that this is because the Wassermann producing substances are derived from two sources—in dementia paralytica from the central nervous system itself, and in the meningeal affection from the exudate from the blood stream as well. It is this material introduced direct from the blood stream as the result of meningeal inflammation which produces the difference, since normal serum unheated is itself capable in low dilutions of producing an inhibition of hemolysis. And, since in this work eight times as much cerebrospinal fluid is used as serum, a small amount of exudate in the cerebrospinal fluid, if unheated, would tend toward giving a falsely positive result. Since the true Wassermann producing substance is thermostable, inactivation of the fluid while increasing the specificity of the test does not decrease its delicacy.

16. Fildes and McIntosh: The Wassermann Reaction and Its Application to Neurology, Brain, Lond. **36**:193, 1913.

17. McIntosh, J., Fildes, P., Head, H., and Fearnside, E. G.: Parasyphilis of the Nervous System, Brain, Lond. **36**:1, 1913.

To express the results we have used figures throughout. In the serum, "4" means a positive reaction, "0" is used to denote a negative. Similarly, with the cerebrospinal fluid a figure is used for each of the four tubes. Where only one figure appears it always refers to the tube containing 0.8 c.c. of fluid. The figures "3, 2 and 1" are used to express partially positive results, and the sign "—" means that the test was not carried out.

The cell counts were usually done immediately after lumbar puncture but always within an hour. Tests for globulin were not made because we considered that for our purpose they would not furnish more information than could be obtained from the estimation of cells and the Wassermann reaction.

The nervous system of most patients with abnormal cerebrospinal fluids was examined as a routine. Symptoms were carefully inquired for; sensation was tested by a wisp of absorbent cotton and with the point of a pin; the functions of cranial nerves except taste and smell were examined, and the state of the reflexes, coordination, and the mental state when indicated, were noted. The eye-grounds were examined by the ophthalmic surgeon of the hospital—Surg. Lieut. Commander R. J. E. Hanson, R.N.V.R. The bone conduction was examined with the collaboration of Temp. Surg. Lieut. E. C. Dunlop, R.N., in charge of the otological department.

RESULTS OF THE EXAMINATION OF THE CEREBROSPINAL FLUID

In considering the cell content of the cerebrospinal fluid the question at once arises as to what number of cells is to be considered abnormal. Without going into details regarding the variations which may normally occur, and considering that it is better to err by having too few cases abnormal than too many, we believe we are following the consensus of opinion in considering 10 cells and over per cubic millimeter, pathological; from 5 to 9 cells (inclusive) per cubic millimeter, "doubtful"; and from 0 to 4 cells, normal. We have thus divided our cases into two groups—"positive" and "doubtful"—the former definitely pathological, the latter much more likely to be so than to be normal. The accompanying tables show the incidence of abnormal cases in each division.

TABLE 1.—INCIDENCE OF ABNORMAL CASES IN EACH DIVISION

Division	Number of Cases	With Positive Cells		With "Doubtful" Cells	
		Number of Cases	Percentage of Cases	Number of Cases	Percentage of Cases
1	71	2	2	9	12
2	168	15	8	17	10
3	107	18	16	11	10
4	85	25	29	11	12
5	78	14	17	11	14
6	115	41	35	14	12

Of the total number of cases we have found 18 per cent. are positive and 12 per cent. "doubtful"; and, if as we think likely, the latter are abnormal, 30 per cent. of all cases are pathological.

It also appears that a small percentage have a pleocytosis even before the Wassermann reaction in the serum becomes positive (Division 1). As the disease progresses this number increases until in the "late secondary" period (Division 4) we find 29 per cent. are "positive," and in the "latent period" (Division 6) no less than 35 per cent. are "positive." The "doubtful" cases do not follow this variation.

It is next of interest to tabulate the incidence of a positive Wassermann reaction in the cerebrospinal fluid in the various divisions.

TABLE 2.—INCIDENCE OF A POSITIVE WASSERMANN REACTION IN THE CEREBROSPINAL FLUID

Division	Number of Cases	Number with Positive Wassermann Reaction	Number per Cent. with Positive Wassermann Reaction
1	71	0	0
2	168	1	0
3	107	3	2
4	85	7	8
5	78	5	6
6	115	26	22

It is seen from Table 2 that in Division 1 there was no instance of a positive Wassermann reaction in the cerebrospinal fluid, while in Division 2 there was only one case, which gave a slightly positive result.

To show the relation of the Wassermann reaction in the cerebrospinal fluid to the number of cells present we have prepared the following table (Table 3).

It will be noted from Table 3 that in every instance but one a fluid with 200 cells or over per cubic centimeter gave a positive Wassermann reaction. Also that with one exception the fluids containing from 0 to 9 cells all gave negative reactions. We will quote this exception in detail.

ILLUSTRATIVE CASE

CASE 88.—The patient had been infected in 1907. The original symptoms and treatment were not recorded. On Nov. 9, 1917, the patient was admitted to the hospital because of a positive Wassermann reaction. He had a general adenitis and scars of ulcers on both legs. Between November, 1917, and January, 1918, he received 2.7 gm. of neoarsphenamin. On April 15, 1918, the patient was readmitted with bilateral eighth nerve deafness. The Wassermann reaction was positive in the serum. The cerebrospinal fluid revealed no cells; the Wassermann reaction was + + + +.

The occurrence of a positive Wassermann reaction in the fluid, in the absence of cells or with normal cells, is very uncommon and is

TABLE 3.—THE RELATION OF THE POSITIVE WASSERMANN REACTION IN THE CEREBROSPINAL FLUID TO THE NUMBER OF CELLS

Number of Cells in the Cerebro- spinal Fluid	Number of Cases with Wassermann Reaction Positive	Degree of Reaction	Number of Cases with Wassermann Reaction Negative
0-9	1	4 --- (0 cells)	508
10-19	3	4 --- (12 cells)	36
		4 --- (14 cells)	
		4 --- (18 cells)	
20-49	4	4 ---	26
		4 4 0 0	
		4 ---	
		4 ---	
50-99	11	4 4 0 0	6
		4 4 0 0	
		4 0 0 0	
		3 0 0 0	
		2 0 0 0	
		4 ---	
		4 4 0 0	
		4 4 0 0	
		4 1 0 0	
		4 4 0 0	
		4 4 0 0	
100-149	7	4 4 0 0	3
		4 4 0 0	
		4 4 0 0	
		4 4 0 0	
		4 4 4 0	
		4 0 0 0	
150-199	4	4 4 0 0	2
		4 4 0 0	
		4 4 0 0	
		4 4 0 0	
200-299	4	4 4 0 0	0
		4 4 4 4	
		4 ---	
		4 0 0 0	
300-499	2	4 4 0 0	1 (476 cells)
		4 4 0 0	
500-999	3	4 3 0 0	0
		4 1 0 0	
		4 ---	
1,000-	2	4 4 0 0	0
		4 ---	
		4 4 1 0	

explained by the previous extensive treatment. It is frequently found that after treatment, a cerebrospinal fluid which has had both a pleocytosis and a positive Wassermann reaction, shows improvement — first, by a decrease of cells, and later by an alteration in the Wassermann reaction. It would appear that Case 88 must have had undetected central nervous system disease in November, 1917, that treatment had reduced the cells of the cerebrospinal fluid to normal at the time of the examination in April, 1918, but the Wassermann reaction was still positive. It is quite possible for the eighth nerve deafness to have progressed as the result of damage done before treatment was given, while at the same time the cerebrospinal fluid was progressing toward normal.

PRESENCE OF SPIROCHETES IN CEREBROSPINAL FLUID

In fifteen of the cases with the highest cell counts, we endeavored to find the *Spirocheta pallida* in the cerebrospinal fluid. All the examinations were made within three hours of lumbar puncture. The fluid was centrifuged at high speed for fifteen minutes, then poured out gently leaving a deposit on the bottom of the tube which was taken up by a capillary pipet and examined under a cover slip by dark ground illumination. In only one case was *S. pallida* found, this man having been infected twenty weeks previously and having 1,000 cells in the cerebrospinal fluid.

GENERAL CONSIDERATIONS

In reviewing the results as a whole it is necessary to consider what previous treatment these patients had received. There are two ways in which it might have influenced our findings: (1) By decreasing the number of positive cases, and (2) by increasing them owing to a provocative effect.

To determine to what extent the provocative factor operated we divided our cases into two groups; (1) the untreated, and (2) the recently treated. In the latter group we included only those patients who had received intravenous treatment within fourteen days before they were examined, because this is the most favorable period in which to observe provocative effects when they occur. In the untreated cases we found 15 per cent. with positive pleocytosis and 11 per cent. doubtful; and in the recently treated cases 15 per cent. positive and 12 per cent. doubtful. The percentages in both groups are thus almost identical, and it is quite apparent that there is no obvious provocative pleocytosis from treatment by arsenical preparations given intravenously.

Comparing the group of untreated cases with those patients who had received intravenous treatment previously to fourteen days before examination, we obtained similar results, and may therefore conclude

that any treatment our patients had received before admission did not affect our findings.

THE RESULTS OF THE EXAMINATION OF THE CENTRAL
NERVOUS SYSTEM

The patients who had any clinical evidence of central nervous system disease, either signs or symptoms, may be conveniently summarized in the following tabulated form.

TABLE 4.—INCIDENCE OF CENTRAL NERVOUS SYSTEM DISEASE IN EACH DIVISION

Division	Number of Cases with 10 Cells or Over per C.Mm. in Cerebrospinal Fluid	Number of Cases Examined Neurologically	Number of Cases with Clinical Evidence of Disease in Central Nervous System	Number with Signs	Number with Symptoms
1	2	2	0	—	—
2	15	11	0	—	—
3	18	15	1	1	0
4	25	23	7	6	2
5	14	12	5	4	3
6	41	36	10	9	3
Total	115	99	23	20	8

Twenty-two "doubtful" cases were investigated. These included some from each of the six divisions, and in only one case (Division 3) was any abnormality found. This man had occipital headache for nine days and his cerebrospinal fluid contained 8 cells per cubic centimeter. In the examination of the internal ear by testing the bone conduction, Weber's, Rinné's and Swabach's tests were used. In Table 5 a summary of our results is given.

TABLE 5.—SUMMARY OF RESULTS OBTAINED IN THE EXAMINATION
OF THE INTERNAL EAR

Division	Number of Cases with 10 Cells or Over per C.Mm. in Cerebrospinal Fluid	Number of Cases Examined for Internal Ear Function	Number of Cases with Internal Ear Function Abnormal	Number of Cases Bone Conduction Diminished		
				Right Side Only	Left Side Only	Both Sides
1	2	2	0	—	—	—
2	15	10	2	0	1	1
3	18	12	4	0	1	3
4	25	19	7	0	0	7
5	4	10	4	0	1	3
6	41	26	18	4	2	7

Nineteen "doubtful" cases were also examined and six were found to be abnormal. Thus, out of a total of ninety-eight cases, thirty-six were found abnormal (36 per cent.).

FURTHER OBSERVATIONS

To determine to what extent this result was due to syphilis we examined in a similar way a series of controls. In fifty nonsyphilitics chosen at random it was found that fifteen had diminished bone conduction, a percentage almost as high as among syphilitics with pleocytosis. In six of these fifteen, gunfire might have been responsible for the abnormality, but in the other nine no sufficient cause was apparent. We also examined fifty syphilitics who had normal cerebrospinal fluids and found that twenty-nine had diminished bone conduction. In thirteen of these gunfire might have caused the defect. We, therefore, in view of the large number of abnormal cases among the controls, are not prepared to attach much importance to diminished bone conduction as indicating syphilitic disease in the central nervous system.

The eye-grounds of fifty-three "positive" cases were examined by Surg.-Lieut. Commander R. J. E. Hanson, ophthalmic surgeon to the hospital. These cases were selected from those having the highest cell counts and represent every division except the first. The following table shows the number of abnormal cases.

TABLE 6.—SUMMARY OF RESULTS OBTAINED IN THE EXAMINATION OF THE EYE-GROUNDS

Division	Number of Cases with 10 Cells or Over per C.Mm. in Cerebrospinal Fluid	Number of Cases Whose Eyes Were Examined	Number of Cases With Abnormal Eyes
1	2	0	—
2	15	3	3
3	18	8	5
4	25	13	9
5	14	7	6
6	41	22	17
Total	..	53	40

No examination of the eyes was made in "doubtful" cases. Surg.-Lieut. Commander Hanson was able to detect very slight but quite definite changes in the eye-grounds, which were considered to be the early stages of the syphilitic retinitis, well known in later stages of the disease. We offer the following notes of this condition written by Surg.-Lieut. Commander Hanson.

"RETINIS EX LUE" (EARLY STAGE)

Typical Signs.—The conditions vary in their intensity but three types of signs in the fundus oculi were noted.

1. Hyperemia: The retinal venules especially were over full.
2. Engorgement: Enlargement and cloudy appearance of the perivascular lymph spaces around the retinal vessels and around the papilla (syphilitic halo).
3. Pigment overgrowth and disturbance in the retina: Small rounded woolly-looking opacities with fine spidery connective tissue changes without apparent upset to the functions of the rods and cones.

In connection with Paragraph 3, it is interesting to recall that there are physical and chemical changes in the cerebrospinal fluid and that this is intimately connected with the subarachnoid contents and these last with the retinal lymph streams. With regard to Paragraph 2, one recalls the extensive pigmentation changes in the skin lesions of the secondary stage.

Summary.—There was little evidence of interference with function, namely, with fields, form sense, light difference, and color thresholds. No alterations in the fundus oculi were observed in the cases seen shortly after the appearance of the inoculation lesions. In the later cases the changes in the fundus oculi were: (1) Symmetrical; (2) mainly peripheral, and (3) diffuse and not circumscribed, that is, not more marked nor intense at one part of the periphery than another. No hyalitis nor choroiditis was observed.

TREATMENT AND ITS RESULTS

Treatment has been confined to the use of arsphenamin preparations given intravenously. We have used neoarsphenamin almost entirely. No mercury has been given. Thus we have made it possible to observe the effect of one drug or one type of drug uninfluenced by the effect of minor therapeutic agents, and although it is at present too early to form any far reaching conclusions on the results of treatment it will be of interest to state what we have already observed.

Whenever possible, patients have been recalled for reexamination or further treatment when this was desirable, and we have been able to make two or more examinations of the cerebrospinal fluid in fifty-four "positive" cases. The details of these cases and the treatment given are shown in Table 7.

DOUBTFUL CASES REEXAMINED

Eight "doubtful" cases (from 5 to 9 cells, inclusive, per millimeter) were reexamined after treatment. Four became quite normal, three remained "doubtful," while one actually showed a "positive" pleocytosis. This case is given in detail:

SUMMARY OF CASE

CASE 1043.—The patient was infected Jan. 28, 1918; he was examined April 17, 1918. He had phimosis, balanitis, subpreputial sores, marked general adenitis, and a papular syphilid. *S. pallida* were present in the penile sores. The Wassermann reaction was positive in the serum. The cerebrospinal fluid contained six lymphocytes per cubic millimeter and gave a negative Wasser-

TABLE 7.—THE DETAILS OF CASES IN WHICH THE CEREBROSPINAL FLUID
WAS REEXAMINED AFTER TREATMENT

Case No.	Before Treatment		Treatment between Examinations		Interval (Weeks) between First Treatment and Reexamination	After Treatment		Division of Disease
	No. of Cells	Wassermann Reaction	Dose, Gm.	Preparation		No. of Cells	Wassermann Reaction	
1219	8	0	3.6	Neocarsphenamin	6	0	0	Div. 1
1220	7	0	2.55		7	4	0	Div. 2
897	10	0	2.55		6	0	0	
1006	10	0	2.05		12	0	0	
1090	14	0	2.7		12	24	0 0 0 0	
1163	10	0	2.7		5	2	0	Div. 3
593	740	4 3 0 0	4.5 0.75		5 9	20 2	0 0	
771	8	0	2.7		7	4	0	
821	10	0	2.55		14	4	0	
831	10	0	2.7 2.7		8 13	28 12	0 0	Div. 4
856	50	0	2.55		8	5	0	
1043	6	0	2.7		8	20	0	
1119	22	0	2.7		6	6	0	
1258	36	4 - - -	2.7		10	0	0	
139	254	4 - - -	2.7		8	14	3 0 0 0	
355	8	0	2.7		8	6	0	
548	1,000	4 4 0 0	4.5 2.7		10 23	42 3	0 0	
555	894	4 0 0 0	4.5		6	16	0	
560	834	4 1 0 0	3.45		5	70	0	
732	48	0	2.7		8	2	0	
783	23	0	2.7		7	2	0	Div. 5
1007	6	0	2.7	Galyl	8 22	6 2	0 0	
1021	12	0	2.7		9 17	2 9	0 0 0 0 0	
1056	290	4 - - -	2.95 4.8		4 10	56 22	4 4 0 0 4 1 0 0	
384	144	4 4 0 0	3.6 1.05		5 14 21	68 20 28	4 4 0 0 - 0 - - 4 0 0 0	
607	38	0	2.7 0.75		6 24	10 10	0 0 0 0 0	
726	66	4 4 0 0	2.7	Neocarsphenamin	7 12	10 10	4 4 0 0 4 4 0 0	
840	42	0	2.55		10 24	8 6	0 0 0 0 0	
876	5	0	2.4		6	0	0	
927	16	0	4.45		5	8	0	

TABLE 7.—THE DETAILS OF CASES IN WHICH THE CEREBROSPINAL FLUID WAS REEXAMINED AFTER TREATMENT—*Continued*

Case No.	Before Treatment		Treatment between Examinations		Interval (Weeks) between First Treatment and Reexamination	After Treatment		Division of Disease
	No. of Cells	Wassermann Reaction	Dose, Gm.	Preparation		No. of Cells	Wassermann Reaction	
956	10	0	2.55	Neosarsphenamin Arsphenamin	9	12	0	Div. 6
1274	200	4 4 0 0	2.7		6	28	0	
1278	8	0	2.55		13	8	0	
125	1,500	4 - - -	1.8 and 0.65		56	18	- - - -	
			3.45		96	10	4 3 0 0	
276	74	4 4 0 0	2.7		13	15	4 0 0 0	
520	107	4 4 4 0	4.5		7	16	4 - - -	
					16	10	0	
619	156	4 4 0 0	3.3		19	12	4 0 0 0	
620	128	4 4 0 0	2.25		6	14	0	
627	14	4 - - -	2.7	Neosarsphenamin	8	2	0	
					11	2	0	
664	11	0	2.7		8	2	0	
705	38	4 - - -	2.7		6	28	0	
					25	252	4 4 0 0	
713	28	- - - -	3.3		14	6	0	
740	112	4 0 0 0	3.6		6	10	3 0 0 0	
			1.8		14	10	3 0 0 0	
753	184	0	3.15		11	24	0	
767	132	0	2.7		8	14	4 - - -	
792	380	4 4 4 0	2.7		8	70	4 4 0 0	
957	10	0	2.7		10	4	0	
969	38	4 - - -	2.7		11	16	4 - - -	
1084	170	4 4 - -	2.4		8	26	4 4 4 1	
1137	82	4 4 0 0	2.4		7	6	0	
1141	102	4 4 4 0	4.65		5	28	4 4 0 0	
1164	1,100	4 4 1 0	?		7	30	4 0 0 0	
					10	0	3 0 0 0	
1177	182	4 4 0 0	2.7		7	8	4 0 0 0	
					13	4	0 0 0 0	

mann reaction. He had six doses of 0.45 gm. of neosalvarsan at three-day intervals from April 18 to May 7, 1918. On June 13, the serum was negative; the cerebrospinal fluid contained 20 lymphocytes per cubic millimeter and gave a negative Wassermann reaction.

COMMENT

There is therefore evidence to show that the central nervous system may be involved although the Wassermann reaction in the serum is

negative. This might occur in two types of cases. Of the first type — the “nerve-relapse” — Case 1043 affords an example. Here, treatment had been sufficient to check the progress of the disease throughout most of the body but had left a few active spirochetes in the nervous tissues, and although they were as yet too few to produce a positive Wassermann reaction in the serum, they gave evidence of their activity by a pleocytosis in the cerebrospinal fluid. The second type is the untreated early case of Division 1.

In Table 1 it will be seen that there are two examples with positive pleocytosis and nine with doubtful. These, of course, are simply cases in which pleocytosis indicates involvement of the nervous system before the Wassermann reaction in the serum is expected to be positive. It should not be taken for granted that all the decrease of abnormalities in the cerebrospinal fluid is due solely to the treatment given. The incidence of central nervous system involvement in early cases is so much greater than the later manifestations of nervous diseases, that it must be admitted that many of the early lesions recover more or less spontaneously.

SUMMARY AND CONCLUSIONS

1. In a series of 624 unselected cases of syphilis in all stages of the disease, 18 per cent. had 10 cells or over per cubic centimeter and 12 per cent. had from 5 to 9 cells, inclusive, per cubic centimeter in the cerebrospinal fluid.

2. In 80 per cent. of cases which had abnormal cerebrospinal fluid there was no clinical sign nor symptom of nervous disease, although 29 cases had over 100 cells per cubic centimeter, 9 had over 300 cells per cubic centimeter, and 3 had 1,000 cells or over per cubic centimeter. Many of the other 20 per cent. had symptoms so slight that they were of uncertain value in pointing one to central nervous system involvement.

3. Some cases of pleocytosis occur soon after infection before the Wassermann reaction in the serum becomes positive. The incidence of abnormality increases as the disease progresses. In Division 4 (so-called late secondary period) 29 per cent. had 10 cells or over per cubic centimeter, and 12 per cent. had from 5 to 9 cells per cubic centimeter in the cerebrospinal fluid.

4. In Division 6 (cases having no active signs of syphilis over six months from infection) 35 per cent. had 10 cells or over per cubic centimeter in the cerebrospinal fluid and 12 per cent. had from 5 to 9 cells per cubic centimeter; 22 per cent. of this division had a positive Wassermann reaction in the cerebrospinal fluid.

5. It has been possible to detect slight but definite early changes in the eye-grounds of many of the positive cases in this series.

6. Diminished bone conduction is not a reliable indication of syphilitic disease of the central nervous system.

7. That the changes in the cerebrospinal fluid were due to syphilitic disease of the central nervous system is demonstrated by the increase of cells, mostly lymphocytes but occasionally a few polymorphonuclears, by the presence of a positive Wassermann reaction in the fluid, and by the fact that *S. pallida* can be demonstrated in the cerebrospinal fluid.

8. A negative Wassermann reaction in the serum does not in every instance exclude the possibility that there is active syphilitic disease of the central nervous system.

9. Previous treatment has had no effect on the number nor on the severity of the abnormalities in our series.

10. Intravenous treatment with arsenical preparations, during the period of our observations, has restored some patients to normal conditions; in nearly all it has had a beneficial effect, but in a few cases the pathological processes in the central nervous system have not been checked even by repeated courses of treatment.

11. The examination of the cerebrospinal fluid is indicated in every case of syphilis.

Abstracts from Current Literature

VEGETATIVE NEUROLOGY AND ENDOCRINOLOGY

YEARLY REVIEW

WALTER TIMME, NEW YORK

Perhaps the most interesting development in the physiology of the vegetative nervous system in the past few years is the attempt of several Dutch investigators to show the dependence of the muscle tonus on the sympathetic ganglionic chain. De Boer¹ and Dusser de Barenne² had apparently shown that section of the abdominal sympathetic chain in decerebrate cats was followed by lack of rigidity in the ipsilateral hind leg muscles of the animal. This diminished tone was evidenced by the limp and lower-hanging affected leg when the animal was held up by the integument of the neck. Also the tail deviated to the more rigid side. Following them, and in opposition, their own countryman Van Rijnberk³ found that in a majority of animals operated on, their conclusion—namely, that section of the abdominal sympathetic affected decerebrate rigidity, was unwarranted. And now comes Stanley Cobb⁴ who likewise denies their conclusions in three negations as follows:

1. Section of the abdominal sympathetic in cats has no effect on decerebrate rigidity.

2. Such section causes no hypotonicity of the hind legs or tail.

3. It causes no changes in the tendon reflexes.

Furthermore, stimulation of the abdominal sympathetic chain causes no tonic contraction of the ipsilateral hind leg. He states that the error made by the Dutch investigators was the banal one of varying the method of holding up the animal by the neck—if a normal animal be held in this way, many variations in hind leg and tail postures can be produced by slight changes in the method of holding. Many elaborate theories have been exploded by just such trivialities in the past, and perhaps this is to be added to them. And yet, from certain unpublished results of experimentation on the dorsal sympathetic chain by the present commentator, it would seem to him that the negative statements of Cobb are too sweeping. The subject will of course go through the regular controversial stages, and some physiological truths will eventually be the outcome.

During the past few years criticism and discussion in the field of neuro-endocrinology has centered to a marked degree about the experiments and conclusions of Cannon on the adrenals and their reactivity to emotional disturbance. This had reached the point early in the current year of giving rise to an editorial in *The Journal of the American Medical Association* based on the experimental work of Stewart and Rogoff,⁵ in which practically all Cannon's

1. De Boer: Ztschr. f. Biol. **65**:239, 1915.

2. De Barenne: Pflüger's Archiv. **166**:145, 1916.

3. Van Rijnberk: Arch. nederl. de Physiol. **1**:702, 1917.

4. Cobb: Am. J. Physiol. **46**:478, 1918.

5. Stewart, G. N., and Rogoff, J. M.: Am. J. Physiol. **44**:543, 1917.

contentions regarding especially the mobilization of sugar as a result of fright were denied and the superstructure reared on these contentions was demolished. In order to retain an impartial view of the whole matter one ought carefully to determine for himself whether or not these experiments of Stewart and Rogoff are of such nature as to be, without cavil, all-conclusive, before denying affirmative evidence such as Cannon adduced. It may be remembered that they stated that in their animals the secretion of the adrenals is abolished by removing one adrenal gland and sectioning the nerves of the other. In these operated animals, hyperglycemia was produced as well as in the unoperated controls, showing that the adrenals were not the determining factor of such hyperglycemia. This conclusion is faulty for the premise is probably false—namely, that they have abolished the flow of adrenalin into the blood stream by their method. In the first place, the adrenals are not the only adrenalin sources in the body. Many chromaffin structures are found elsewhere along the course of the large blood vessels especially at their points of confluence, and all enmeshed with sympathetic nerve fibers; under which conditions blood from the adrenal veins might very well be found negative to adrenalin presence, albeit present in some measurable concentration elsewhere in the vicinity of these other centers of chromaffin supply; and, secondly, direct pressure on the adrenal bodies by deep diaphragmatic breathing or other pressure will release adrenalin notwithstanding splanchnic nerve section. So that these two sources of adrenalin must be eliminated before Stewart's and Rogoff's conclusion is justified. To blast Cannon's theories on such inconclusive evidence seems unwarranted.

The effect on the blood vessels of *adrenalin* administered hypodermatically had been accepted more or less universally as being constrictive in all groups and systems excepting the pulmonary, cerebrospinal and the coronary. These results were more or less true when large amounts of adrenalin were used. And yet such amounts are probably never secreted by the suprarenals. Small quantities almost invariably produce a vasodilatation.* This is a fact largely ignored in spite of the cumulative evidence in its favor. The differential effects produced by adrenalin on cats and dogs is summarized briefly by Hartman⁶ as follows: Dilatation in skeletal muscle and intestine (small dose), kidney, bone, thyroid and spleen. With small doses the vessels in skeletal muscle more than counteract the constriction in skin and viscera, and a fall in blood pressure results. When the amount of adrenalin is sufficiently large, the constriction of skin and visceral vessels (excepting intestinal) becomes great enough to more than compensate for the dilatation in skeletal muscle, thus producing a rise in blood pressure.

Interest in the thyroid gland is much enhanced, if this were possible, by the isolation in crystalline form of a thyroid hormone by E. C. Kendall of the Mayo Foundation. And not only has the hormone been analytically obtained, but in the past year is said to have been synthesized as well by one of Kendall's assistants. This substance has been called by Kendall, "thyroxin." Its administration in doses as small as a milligram (per day) is followed, in cases of myxedema, by the same curative reaction as follows the use of whole thyroid gland. It has been stated by Plummer, who has given much time to

6. Cannon and Lyman: The Depressor Effect of Adrenalin on Arterial Pressure, *Am. J. Physiol.* **31**:376, 1913; Hartman: The Differential Effects of Adrenin on Splanchnic and Peripheral Arteries, *Am. J. Physiol.* **38**:438, 1915.

7. Hartman: *Endocrinology* **2**:123, 1918.

studying the effects of this active principle, that 10 mg. of thyroxin increase the basic metabolic rate in myxedema 30 per cent. This seems to be the key to the effect of the thyroid hormone in the physiologic activity of the body.

Kendall's method of obtaining thyroxin may be briefly stated as follows: The thyroid proteins are broken into simpler constituents by alkaline alcoholic hydrolysis. These may be separated into two groups as the basis of their solubility in acids, which groups be designated as A and B, respectively insoluble and soluble. The Group A compounds are further separated by continued hydrolysis and the iodine-containing compound isolated in pure crystalline form, with a constant iodine content of 60 per cent. The A iodine compound is "thyroxin." The B compound produces no toxic effects though it seems to possess physiologic properties in certain conditions of the skin.

Starting from the premise that hyperplasia of the anterior lobe of the pituitary body is associated with giantism and acromegaly, T. Brailsford Robertson, then of the University of California, in his experimental studies on growth, especially on the growth of carcinomas in rats as influenced by the secretion of anterior lobe of the pituitary gland, was finally enabled to isolate from the anterior lobe an extract named by him "tethelin" which seemingly resembled the growth factor present in the anterior lobe of the pituitary in all its bearings.

Tethelin is a lipid, readily hydrolyzed by alkalies, and hence probably partially decomposed by intestinal alkaline juices when administered by mouth. However, it is not totally wasted by such procedure for growth effects are obtained in young mice even when given this way. As it is free from protein contamination, and is soluble to the extent of 5 per cent. in water it may be used for a variety of experimental purposes to which the anterior lobe extract does not readily lend itself. As to its therapeutic properties, it was found that the animals fed with it, had exceptionally good coats, with smooth hair, both abundant and glossy, at an age when normal animals have already begun to lose their hair and whose coats are rough and shaggy. These effects are similar to the hypertrophy of the epidermis and hypertrichosis seen in acromegaly. Taken in connection with the stimulative action of tethelin on carcinomas, it would seem that tethelin is a specific stimulant of epithelial growth. Tethelin is soluble in alcohol and ether, contains phosphorus and nitrogen in the ratio of 1:4 and is precipitated from alcoholic solution by admixture of a definite proportion of ether. As so peculiar a substance was found present in relatively large amounts in anterior lobe extracts, it necessarily fell under suspicion of being the active agent, and the effects of administration amply confirmed this suspicion.⁸

The muscular dystrophies seem to be fairly included now in the domain of the internal secretive disorders. Two groups of observers, taking up the clinical and metabolic aspects of these disorders, have arrived at this conclusion. By virtue of the extreme frequency of pineal shadows seen in adolescence in these cases of dystrophy, coupled with a high percentage of antecedent glandular disturbances in the ancestors and collaterals, together with the resemblance seen in the early symptomatology of pineal neoplasms and muscular dystrophy, Timme⁹ postulates a relationship between dystrophy and

8. Robertson, T. Brailsford: *J. Biol. Chem.*, **24**:397, 1916.

9. Timme: *Arch. Int. Med.*, **19**:79 (January), 1917.

the endocrine system notably the pineal body. He examined five members of one family in whom the disease was familial for four generations and found pineal shadows in four of the five.

From the metabolic viewpoint¹⁰ it has been shown that the biochemical

10. Janney, Goodhart and Isaacson: *Arch. Int. Med.*, **21**:188 (February), 1918. reactions in cases of progressive muscular dystrophy give results resembling those obtained in many hypo-endocrine disturbances; namely, a decrease of pre-formed creatinin in the urine; abnormal presence of creatin in the urine; low creatinin values in the blood; a normal amount of creatin in the blood; hypoglycemia and delayed glucose utilization. MacCradden had a year earlier demonstrated the lowered blood sugar content in the blood of a case of progressive muscular dystrophy, and treatment based on such findings has given him some result.

SUGGESTIONS FOR A SCHEME OF GRAPHIC REPRESENTATION OF PERSONALITY AND PSYCHOSIS. H. DOUGLAS SINGER, M.D., *J. Abnorm. Psychol.* **12**: No. 2, pp. 114-130.

It is quite evident that the importance of the relationship of personality and psychosis is getting more and more appreciated. This forms a part of the general tendency which is fortunately coming into psychiatry, perhaps especially in this country, toward a dynamic view of, especially, the constitutional psychoses. This study of Singer aims at systematizing our knowledge regarding personality and psychosis, so that the facts can be put into sufficiently concise form for grasping them and for making generalizations. This is especially important for the functional neuroses and psychoses. Singer is fully aware that all such schemes are as yet tentative. He endeavors to represent the personality traits and the symptoms graphically, by putting them in parallel columns—one side for the traits of endowment, the other side for the psychotic symptoms. Among the former he begins with energy, under which he takes up the vigor of reactions; then the mood; then intellectual endowment. The modes of adjustment are next considered. Here we first have what he calls the primitive or sensual, that is, an entirely frank gratification of desires. Singer says that the questions considered under this heading seem sufficiently obvious to require no special discussion here, but one would have liked nevertheless if Singer had been more explicit. A useful grouping is, however, his division into helpful, harmless and harmful substitutions. The helpful substitutions are those of a domestic, social, practical, artistic sort, the test, wisely, being whether they lead to real accomplishment or activity in the field selected. Harmless substitutions are those which represent a certain outlet of energy but which represent no social gain, such as hobbies. Finally, the harmful substitutions are those which do not accomplish anything and which, moreover, bring the individual into more or less conflict with the environment. Here we find irritability (defined as a substitution of aimless activity for a frank and purposeful method); overscrupulousness (indecision with futile worrying and a tendency to great exactitude in detail); explosive effects such as tantrums; transient enthusiasms; religious fervors; hypochondria (a failure to face actual situations, while an explanation of bodily incapacity is substituted). The next heading is drug addiction. Then comes suspiciousness (a translation of failures into interference by others, etc., which so alter the facts of the situation as to render adjustment to the real facts more or less impossible). Then follows bashfulness, superstitiousness (the tendency to ascribe personal failures to unknown influences). Finally

day-dreaming is taken up (a tendency to seek the gratification of desires by imagining the end as accomplished), and mannerisms.

For the sake of brevity the correlative psychotic symptoms cannot be entered on. Some charts illustrate the method. A chart of manic excitement shows the predominance of frank features; the opposite is seen in dementia praecox. Interesting is the fact that an analysis of a paranoid reaction shows some features similar to dementia praecox (though not the more marked shut-in traits) but with strikingly better energy endowment.

There is no doubt in the mind of the reviewer that the method is a fruitful one for study as well as for teaching purposes.

HOCH, Santa Barbara, Calif.

+

THE TREATMENT OF GENERAL PARESIS. CLARENCE A. NEYMANN, M.D., and NATHANIEL H. BRUSH, M.D., *Arch. Int. Med.* 22:245 (August), 1918.

At present there are several forms of therapy. The so-called mixed treatment—mercury and potassium iodid—may be discarded as used alone. That it is a valuable aid to other forms of therapy there can be no doubt. Next to this in simplicity is the intravenous treatment. Certain cases may be benefited by intravenous use of arsphenamin or its substitutes but there is always the danger of hypertherapy. The resistance of the choroid plexus and the meningeal blood vessels to chemical compounds of complex molecular structure has been demonstrated. Intrapinal therapy with arsphenaminized serum is undoubtedly useful, but the same objections may apply here that characterize the intravenous method. If arsphenaminized serum is given every seven days, great care must be taken to avoid bladder, rectal and other root disturbances. A patient may react well to the first five or six treatments and have subjective or objective bladder disturbances with the seventh. More or less permanent motor root disturbances as well as perineal and sacral anesthetics and paresthetics have been observed after the intraspinal administration of arsphenaminized serum.

The reactions obtained with mercurialized serum (prepared according to the Byrnes method) are entirely different. Immediate reactions are more severe but permanent injury to the muscular or sensory innervation is not observed. This method alone has not given the best results. High dosage is often resorted to in the attempt to check the process. Several reactions will be met, such as high temperature, extreme pain, meningismus, nausea, etc., due to the enormous amount of irritation. The intraventricular treatment and the intradural methods merit consideration. It has been shown that the flow of spinal fluid is toward the foramen of Magendie starting from the ventricles and from the spinal canal. Based on this fact such a therapy is most rational. Dread of necessary surgical procedure prevents most patients from taking advantage of such a method.

The treatment outlined by the authors is, in fact, more or less of a combination of the aforementioned methods.

After the diagnosis is established, the patient is put on a routine course of mercurial inunctions and potassium iodid by mouth. Careful attention is paid to mouth hygiene during the entire period of the treatment. These inunctions are given six days a week and a hot bath on the seventh day; also a saturated solution of potassium iodid is given beginning with 15 drops three times a day, and increasing 1 drop a day until the maximum of 150 drops a day is reached. Usually furunculosis is noticed before this time, thereupon the iodid is discontinued for about a week, to be later recommenced at 15 drops three times a day.

Arsphenamin is given intravenously, beginning with 0.2 or 0.3 gm., according to the body weight of the patient. If the patient reacts badly to this initial dose, all treatment is discontinued and no further attempt is made to treat him. They consider as serious reactions any signs of arsenical rash, neuritis, albuminuria, and marked circulatory disturbances—that is, syncopal attacks.

The next week the patient is given 0.5 or 0.6 gm. of arsphenamin. At the completion of the arsphenamin administration, 50 c.c. of blood are withdrawn into a sterile centrifuge tube, a lumbar puncture is made and the spinal canal is drained.

Investigators are of the opinion that this procedure partly overcomes the aforementioned resistance of the choroid plexus and meningeal vessels to the drug. It is marvelous how much fluid one can withdraw from the spinal canal of a paretic without causing the slightest discomfort; in fact, the more fluid withdrawn, the less reaction is likely to result. The authors have withdrawn as much as 80 c.c. at a time.

The next day the blood, which has been allowed to clot in the icebox overnight, is centrifuged, poured into a second sterile centrifuge tube, again centrifuged and inactivated in a water-bath at 56 C. for half an hour. This overcomes the use of pipets, which, even when plugged with cotton, always involve the danger of salivary contamination.

The third week $\frac{1}{100}$ grain of mercury (Mulford's mercurialized serum) is given intraspinally. Though it is known that animals can be sensitized to foreign protein by intraspinal injections, anaphylactic reactions following the use of this particular preparation have not been observed.

The fourth week, arsphenamin and arsphenaminized serum are again given as described.

The fifth week $\frac{1}{80}$ grain of mercury is introduced in the spinal canal, provided the patient has theretofore shown no unfavorable reaction after the initial dose. From now on the alternate treatment with arsphenamin and mercury intraspinally proceeds regularly. Whenever a patient begins to evince signs of debility, it is best to give him a complete rest and discontinue all treatment.

Twenty-four cases were so treated. Based on results they can be divided into four groups of six patients each. The patients of the first group are all doing well, and with the exception of one have been discharged from the hospital and are at work. The serologic findings of the spinal fluids of five are practically negative. It is possible to change the serologic findings of most patients after this intensive treatment. They may not be permanent. The cell count is the easiest to reduce. Repeated spinal punctures will do so. At least eight intraspinal treatments must have been given before any change is noted in the spinal fluid Wassermann test; often it takes from fifteen to twenty injections. In successfully treated cases traces of the syphilitic ambceptor may be found. The gold curve is changed only after a maximum number of doses have been given. It is not usual for the gold curve to revert to a completely negative reaction. The average duration of the present status of this first group is fifteen months. These are considered as arrested cases.

The second group of six is less satisfactory although somewhat improved. Four of this group resumed their occupations while two are continuing their treatment. This group show some serologic improvement.

The third group showed no clinical or serologic improvement. The last six were harmed by the treatment—one developed a paraplegia; two became incontinent; one died of acute arsenical poisoning, and one developed an arsenic neuritis; finally, one died in convulsions possibly as the result of treatment.

The points in the treatment to be emphasized are (1) long-continued intensive methods as indicated, and early diagnosis; (2) careful use of all arsenic preparations, as the danger of motor and sensory root disturbances cannot be entirely avoided.

There is scarcely a single psychotic manifestation which cannot be simulated by general paresis. Serologic findings may prove a case to be one of general paresis when neurologic and physical findings are not at all characteristic. Complaints may be mostly neurasthenic and hypochondriacal. Importance should be attached to these subjective feelings and to minor neurologic conditions. Often friends or the family may furnish evidence of slight and gradual retrogression. These facts coupled with the laboratory findings may aid in determining the diagnosis. A positive Wasserman reaction in the blood and spinal fluid, a paretic gold curve, a high cell count, and positive globulin tests in a case that shows any mental symptoms whatever may be classed as one of incipient paresis. It is interesting to note that, in a large series of paretic patients examined by the authors, 23 per cent. showed a negative blood Wassermann reaction.

The results obtained by Neymann and Brush considering the types of patients dealt with were excellent, and show the value of coordinated clinical and laboratory work.

WEISENBURG, Philadelphia.

WAR PSYCHOSES: A report of six unusual cases showing memory disorder.

TEMP. CAPT. D. K. HENDERSON, M.D., *Rev. Neurol. & Psychiat.* May and June, 1918.

The author has described six cases of very unusual war psychoses. All of them fit more or less into the Korsakow syndrome, showing extraordinary memory defect, confabulation and an absence of retention for recent events. The first three showed this mental picture, following burial. Of the other three, one followed dysentery, one enteritis, one dysentery plus malaria. These last three are good examples of toxic-exhaustive states and showed a more or less typical Korsakow syndrome; thus the picture is not unlike that encountered in civil life. The first three cases are much more unusual and would probably best be considered as examples of what Mott has termed "commotio cerebri," and the condition in each may possibly have been accentuated by the inhalation of noxious gases.

However, all six cases have much in common as far as the mental history is concerned. It is not by any means unusual to see cases with amnesia for the period of burial, often lasting hours or days afterward; but it is exceedingly uncommon to see cases showing the peculiar confabulatory state described.

The close association between cause and effect, the patients developing their peculiar mental state directly after the accident, would seem to put the hypothesis of mental shock out of the count. Furthermore, all of these three cases, up until the accident occurred, had been able to "carry on" as formerly. Further, the mental picture exhibited by each was much more in the nature of an organic than of a functional type of reaction.

The observations of the author seem timely. After Mott's first description of minute hemorrhages into the brain and the assumption of an organic basis for many cases of so-called "shell-shock" a justifiable reaction among the psychiatrists took place. Many so-called organic cases proved to be functional. It is therefore of great interest to note these three cases, undoubtedly on an organic basis.

NEYMANN, Baltimore.

CONDUCTION IN PERIPHERAL NERVE AND IN THE CENTRAL NERVOUS SYSTEM. E. D. ADRIAN, M.B., M.R.C.P., *Brain*, Lond., 41: Part I, 23-47, 1918.

The paper is largely a summary of the work of Keith Lucas on the conduction of the nervous impulses considered from the neurologic standpoint. When the frog's sciatic nerve is stimulated mechanically, electrically or chemically the gastrocnemius muscle contracts after a short, appreciable interval. The stimulus sets up some disturbance in the nerve, which travels down it at the rate of 28 meters a second. The nature of this nervous impulse is unknown and only the electrical response which accompanies it can be detected. It has been found that the stimuli must be separated from one another by more than 0.003 second or the subsequent stimulus will fail to set up the nervous impulse. If the stimuli are repeated with sufficient rapidity the number of nervous impulses may be only a fraction of the number of stimuli. The activity of the nerve fiber, therefore, is not continuous, and conduction proceeds by means of a series of discrete impulses which cannot follow one another at less than a certain interval. This interval is known as the refractory period. There is an all or none relation between the strength of the stimulus and the contraction of the muscle fiber, as shown by experiments with preparations containing very few nerve and muscle fibers.

The intensity of the nervous impulse can be measured in terms of its ability to travel through regions of decrement produced by narcotizing varying lengths of nerve fiber with varying intensity. It is thus found that the intensity of the impulse does not vary with the strength of the stimulus, that stronger stimuli have no advantage. An impulse reduced in intensity recovers again when it passes out of the region of decrement into normal fiber. In a normal fiber, therefore, the intensity of the impulse at any point depends only on the local condition of the fiber at that point. Recovery after the passage of the impulse may be divided into three stages.

1. The absolutely refractory period when all activity is abolished.
2. The period of depressed activity, in which the nerve conducts an impulse of small intensity and needs a very strong current to offset it.
3. The period of enhanced activity, when the excitability is greater than the normal and the intensity of the impulse is also greater.

Central conduction differs from peripheral mainly in the greater susceptibility to fatigue of the synapses and in the property which enables a single impulse in the afferent nerve to set up a series of impulses in the efferent, so that the response may outlast the stimulus by several seconds. We may suppose the central nervous system to consist of a number of neurons communicating with one another by junctional areas or synapses. The synaptic areas are regions of imperfect conduction; the impulse suffers a decrement as it passes through them. The duration of the refractory period and the extent of the change which occurs in the period of enhanced activity may vary and may have different values in different synapses or different parts of the same synapse. At some point in the synaptic region the passage of a single impulse may initiate a succession of impulses, and at another conduction is possible in one direction only.

Whatever our conception of the central nervous system may be, there can be little doubt that the amount of energy leaving it by afferent nerves may be considerably greater than the amount entering it as a result of an external stimulus. Wherever afferent nerves branch repeatedly there is a possibility of turning one impulse into two, the increased energy being supplied locally by the fibers themselves.

If the central nervous system contains regions of decrement there should be no difficulty in accounting for at least one form of inhibition and summation analogous to that encountered in the peripheral nerves. In view of the complications introduced in the central nervous system where the impulse has to pass through several relays of conductors and junctional regions with different rates of recovery the most varied possibilities are opened up without introducing any assumptions that have not been proved in the case of peripheral conduction.

If we grant that the synaptic regions may have different rates of recovery there is no difficulty in explaining the fact that stimulation of an afferent nerve may lead to contraction of one muscle and inhibition of its antagonist. We must suppose that the frequency of the impulses reaching the final common path of the inhibited muscle is so great that all the impulses are of subnormal intensity and are therefore extinguished before they reach the muscle. The frequency of the impulses reaching the muscle which contracts must be slower, so that the impulses shall be large enough to pass. These conditions will be realized if at some point on the path leading to the muscle which contracts there is a region which recovers so slowly that every other impulse from the afferent nerve arrives during the absolute refractory period and is extinguished completely. The effect of this will be to halve the number of impulses passing toward the muscle, so that each will be large enough to avoid extinction; in the other path, where the impulses do not pass through a region of slow recovery, the frequency will be great enough to cause inhibition.

Most of the phenomena of reciprocal innervation may be accounted for by a mechanism of this type. However, difficulties begin to arise when we come to consider the balanced effects of inhibitory and excitatory stimuli.

The suggested mechanism of central conduction may prove to be absent or present only in a small degree. However, the hypothesis has the advantage that it does not demand any properties in central conduction which cannot be shown to exist in some degree in simple conducting tissues.

REYE, Detroit.

THE EAR IN STUNT FLYING. MAJOR LEWIS FISHER, M.C., and CAPT. HARRY LYMAN, M.C., *J. A. M. A.*, 71:1977 (December), 1918.

Neurology has always fostered the careful study of the relation of special-sense-mechanisms to the central nervous system. Because of the elaborate and intimate connection of the ear with the nervous system a study of the ear-mechanism has opened up a peculiarly attractive and promising field of investigation to the neurologist and otologist. During the past several years many investigators have made clinical contributions in the application of these studies to the problems presented in cases of vertigo, syphilis of the central nervous system and intracranial localization.

In the past two years aviation, as an important factor in the war, brought with it many new medical problems which have proved to be largely neurologic. Among these were numerous neuro-otologic problems—the paper of Major Lewis Fisher and Capt. Harry Lyman being of peculiar interest. The article emphasizes the following points:

1. That crashes during stunt-flying result as a rule from something having gone wrong with the pilot rather than with the machine—that errors of judgment, carelessness, etc., do not adequately explain these accidents—that many pilots who survive such crashes speak of having been affected by a momentary loss of faculties due to an over-powering dizziness.

2. The realization that during stunt-flying the pilot is whirled violently in space, and a knowledge that the ear is the chief organ affected by whirling, naturally directed the attention to the study of the ear-mechanism.

3. Whirling experiments conducted on experienced aviators have shown conclusively that the various aerial evolutions, or "stunts," can be exactly imitated or reproduced by whirling them in a laboratory apparatus—that by whirling them in a certain way the aviators would feel as though they were in a "spinning nose-dive" and that whirling them in another direction they would feel as though they were doing a "tight spiral," etc.

4. The facts gleaned by these experiments were in absolute accord with well known otologic principles and the knowledge of the ear as a motion-sensing organ, and demonstrate conclusively that stunt-flying is essentially an ear problem.

5. The otologic facts and principles referred to were: (a) Each inner ear in addition to the cochlea, or the hearing portion, consists of a common chamber from which project three semicircular canals at right angles to each other—the entire system containing fluid. Because of this arrangement no change of position is possible without producing some movement of fluid in one or more of the canals. Movement of fluid in these canals stimulates nerve-endings and results in certain messages to the brain which are there interpreted as body movement. Therefore, the ear constitutes one of the motion-sensing organs of the body. (b) When an individual is whirled—be it in the laboratory or in an aeroplane—there is produced a movement of fluid in certain definite canals and planes. If the turning be suddenly altered or stopped, or the aeroplane comes out of a rotating maneuver, the fluid in the canals continues to move in its former plane by sheer force of momentum. This circulation of the fluid (by momentum) is interpreted by the individual as body movement, but not being in accordance with fact, the body having ceased to revolve, constitutes vertigo or dizziness, and is disturbing to the individual. Labyrinthine vertigo, therefore, is a false sensation of motion similar to the visual illusion of motion observed when watching a moving train from the window of a stationary coach, both being unavoidable phenomena of normal special sense mechanisms which, however, the subject easily learns to interpret and disregard.

The authors warn those who are prone to draw hasty conclusions not to be misled into thinking that individuals in whom the labyrinths have been destroyed, congenitally or through disease, would be peculiarly adapted as aviators because of the immunity from vertigo which they would enjoy as a result of a lack of a normal ear-function. The importance of the ear-mechanism as a motion-perceiving apparatus is of such overwhelming usefulness to an individual traveling in a fluid (air) medium that the advantage derived from a vertigo immunity is as nil compared with the benefits derived from the former. This is particularly evident to those who have seen how deaf-mutes are completely lost when taken up in an aeroplane and are absolutely unable to detect the direction of movement the moment they close their eyes. Furthermore, normal individuals can acquire vertigo immunity without much difficulty in a short time.

The various "stunts" or air maneuvers are then analyzed from an otologic standpoint. Thus, for instance, in the so-called spinning nose-dive in which the aviator, face downward, is whirled about an axis with head and body practically parallel to the ground, there is a stimulation in the vertical semicircular canals in a frontal plane. When he comes out of the spin the plane of vertigo, which until now has been parallel to the ground or horizontal,

becomes vertical in a frontal plane, so that instead of feeling that he is whirling horizontally, he feels himself whirling in an up and down plane. This being very disturbing he is apt to lose himself momentarily, and in attempting to correct for this illusory movement, to throw himself into another spinning nose-dive in the opposite direction. The identical condition can be simulated in the turning chair. When he is whirled with his head forward it simulates his position during the spinning dive. When he attempts to sit up after the turning, he similarly changes the horizontal vertigo with which he started into a sensation of whirling in a vertical plane. Here, too, he attempts to correct the false impression and in doing so he throws himself to one side or the other so markedly, that unless caught by the examiner he falls to the floor. The obvious remedy in both instances is to keep the head down in the original position so that the vertigo always remains in a horizontal plane.

Experienced fliers are not upset by the vertigo induced during stunting for the reason that continuous practice in the air and many repetitions have taught them to properly interpret the confusing subjective sensations, so that they learn to disregard them. Some fliers also assume instinctively those positions of the head which tend to keep the plane of vertigo horizontal at all times, in this way minimizing any disabling effects induced.

The usefulness of the knowledge that stunting is an ear-problem is twofold: (1) The flier may be taught to assume certain positions of the head during or following certain stunts, and in this way minimize any disturbing effects, and (2) the flier may acquire safely a vertigo tolerance or education in a laboratory apparatus instead of in an aeroplane among the clouds. This is accomplished by the orientator, a mechanical apparatus so constructed that any evolution in an aeroplane, except actual forward progression, such as the "loop," "barrel-roll," "Immelmann turn," "the spinning nose-dive," "ascending and descending spirals," "the wing-over," etc., can be successfully reproduced in the machine.

JONES, Philadelphia.

A CASE OF CHILDHOOD CONFLICTS WITH PROMINENT REFERENCE TO THE URINARY SYSTEM; WITH SOME GENERAL CONSIDERATIONS ON URINARY SYMPTOMS IN THE PSYCHONEUROSES AND PSYCHOSES. C. MACFIE CAMPBELL, M.D., *Psychoanal. Rev.* 5: No. 3, pp. 269-290.

This is an interesting study of a child observed at the dispensary from the age of 7 to 11. She was boisterous, inattentive, bizarre in her behavior, and presented some very definite trends, namely, obsessive questioning, a tendency to bed-wetting and wetting herself in the day time, together with deliberate retention of urine, intense interest in plumbing (questioning about water pipes, sewers, even attempt to get down into the sewer), frequent questioning also about urine, where it comes from, where it goes. She also had a tendency to exhibitionism at home and in the doctor's presence. A certain coquettishness and a constant desire to be examined physically by the physician, were also present. The patient was not analyzed and not questioned. Finally, she spontaneously gave naively direct expression to pleasurable sensations associated with urination and with fullness of the bladder, also to

her sexual interests in her little brother's genitals and to sexual playing with him—all of which, without any special interpretation, put into a clear light the reasons for her peculiar behavior before.

Campbell calls attention to a case of Havelock Ellis in whom also direct expression was found of pleasurable sensations connected with the act of urination and with a full bladder. He reports some neuroses in which, in view of these findings, it would seem that those positive pleasures, in addition to other motives (in the cases particularly the desire to shirk marital relationship) may account for retention of urine and frequent urination. The relationship of the sexual instinct with urination is often seen in schizophrenia, and he mentions a case in which the act of drinking urine was frankly associated by the patient with the sexual act. In general, the pleasurable nature of the urinary activity frankly admitted by this little girl, Campbell says, throws light on all sorts of urinary symptoms in childhood, as well as similar symptoms in psychoses and neuroses; it shows the possible relationship of symptoms referable to urinary activity with the sexual instinct, and it also throws light on obsessive questioning in children (interpreted as due to an interest which was not allowed direct expression), on peculiar interests (here in plumbing, etc.), peculiar attitudes, and the like. Moreover, "such an experience with a child of poor nervous endowment may sensitize us to minor manifestations of similar conflicts in the life of the ordinary child."

HOCH, Santa Barbara, Calif.

WAR PSYCHOSES: Amnesia as a Defense Mechanism for Desertion. TEMP.

CAPT. D. K. HENDERSON, M.D., *Rev. Neurol & Psychiat.* May and June, 1918.

The author gives a careful and exhaustive study of fourteen cases of amnesia examined by him. All these were men in the military service, who had left the lines or their camp, were arrested as deserters, and claimed a loss of memory for the whole period of their wandering. In some cases these fugue-like spells may seem to be synonymous with flight or desertion, while in others they can be traced back to fairly definite factors.

The cases naturally fall into three large groups: (1) those organically determined, for example, head trauma, general paralysis, mental deficiency, epilepsy, toxic-exhaustive states; (2) those associated with well-recognized forms of the psychoneuroses or of functional types of mental disturbance, for example, manic-depressive insanity, dementia praecox, and (3) those who had never shown any previous special psychotic symptoms but who later were shown to have developed the amnesia on the basis of complex factors. It is, of course, this latter group which gives rise to a great deal of difficulty, and in which the question of responsibility, or lack of it, comes acutely to the fore-front.

Six of the fourteen cases described in detail by the author fall into the first group. Two are examples of recurrent amnesia after severe head traumas, in patients who had been sick before entering the service. In one the amnesia was due to general paresis, and in another the main etiologic factor was undoubtedly overindulgence in alcohol. This had seriously undermined his constitution and had caused such a general mental reduction that the patient really had become irresponsible for his action. The other two cases are good

examples of wandering fugue-like states with amnesia in mental defectives. The mental defective has great difficulty in adapting himself to the ordinary stress and strain of military life, and under shell fire he very easily becomes befuddled and in consequence is apt to wander away from his unit.

These two cases of mental defect are good examples of many such. The patients, by their foolish actions, are very apt to be a source of danger to all associated with them, and should be rigidly excluded from the army, or at least from active service. They, of course, cannot be held responsible for any of their foolhardy and foolish acts.

The next four cases fall into the second group. Two had a psychoneurotic make-up; one had a hallucinatory paranoid trend before entering the service; one gradually developed a mental disturbance while in the service. The mental disturbance of this last patient seems to have been caused entirely by the stress and strain of active service. His resistance became lowered, an amnesia developed, no doubt as a defensive measure, and his latent trends asserted themselves.

In the last four cases belonging to the third group, the amnesia came, more or less, out of a clear sky, and was the first indication that anything was seriously wrong with the patient. It is extremely difficult to determine how far these patients were conscious of and should be held responsible for their acts.

In the cases belonging to the organically determined and to the functional nervous and mental disorder groups it has usually been easy enough, by means of a careful history, to make sure that the individual in question was unstable, and at the time the amnesia took place was nervously or mentally affected. Particularly in the cases of general paralysis and mental deficiency, it will be readily admitted that the mental disorder is such that any person so suffering could not be held responsible for his acts. In the other cases belonging to these two groups—for example, the cases with head injury, alcoholism, psychoneuroses, and schizophrenia—it is a difficult problem to decide how much weight in the production of the amnesia should be given to the head injury, to the alcoholism, and to the various types of mental disorder exhibited, and how much emphasis should be laid on the psychological factors which were also present.

In all the groups the amnesia has been a defense reaction toward a situation which could not be met in a healthy, aggressive way. In the cases belonging to the first two groups this reaction has taken place at a more or less unconscious level; while as regards the last group, it has taken place at a more or less conscious level. How far the patients of the last group should be held responsible for their acts is open to fair argument.

NEYMANN, Baltimore.

OBSERVATIONS ON TWO HUNDRED AND FIFTY CASES OF GUN-SHOT WOUNDS OF THE PERIPHERAL NERVES. MAJOR C. NOON, R.A.M.C., J. Roy. Army Med. Corps, London, 31:39, 1918.

Although the conclusions of the author are somewhat platitudinous, such as, "Successful recovery depends on early, correct and continuous treatment," he has had the opportunity of examining 250 cases of this kind of injury and has operated on 102 of them. He divides the clinical phenomena into four syndromes:

1. The syndrome of complete division of the nerve trunk is characterized by complete paralysis in the muscles supplied by the divided nerve, loss of both protopathic and epicritic sensibility, pallor and coldness in the part affected, diminution in the subcutaneous fat, a dry skin and frequently ulceration of the skin.

2. The syndrome of compression often follows, in the form of a relapse, after an early improvement. These cases are the most numerous and the most favorable for operative treatment. The motor paralysis is less marked than when the nerve has been divided and the trophic lesions do not occur, but there is a form of sensory dissociation in that the area of loss of sensibility to pain, as tested by the pin prick, is greater than that in which there is loss of sensation to light touch.

3. The syndrome of incomplete lesion with irritation shows an incomplete paralysis accompanied by neuralgic pains in the part. The skin is glossy and a mottled red, and tender to stimuli. There is generally a profuse sweating over the part affected, and the sweat is strongly acid and bad smelling.

4. The syndrome of interruption, followed by restoration of function, is shown by a loss of sensation and motor power but little, if any, wasting. These cases usually recover completely in about three months, and an operation is not required. The nerve is probably not directly injured but suffers from concussion.

An operation is urgently needed in the case of a divided nerve, and the ends of the nerve should be brought together and united as soon as possible. Even when there is a considerable gap between the ends of divided nerves they can usually be brought together, if the operation wound is large enough to permit a considerable portion of the nerve to be exposed; for instance, in operating on the ulnar nerve in the forearm the incision should be from just below the elbow down to the wrist. The nerve should first be freed above and below the injury and dissected out carefully; often it will be found that there is a bridge of fibrous tissue joining the two ends of the nerve and, before this is divided, a fine silk suture should be passed vertically through each end. This is of great value in retaining the proper orientation of the ends of the nerve so as to join together the corresponding nerve bundles. If the nerve, after suture, can be placed in a bed of healthy tissue it is not necessary to surround it with any foreign tissue, but if there is much scar tissue present the author prefers to suture the nerve loosely in a bed of fat cut from the patient's own thigh. A very important point is that the limb should be so bandaged that there is a minimum of tension on the nerve.

Electricity, massage and passive movements are of great value in the after-treatment, and the cases may continue to improve even after two or three years. Electrical treatment should be continued for at least six months after an operation.

The ulnar nerve was the one most frequently injured; the median, musculospiral and external popliteal followed in the order mentioned.

CAMP, Ann Arbor, Mich.

PALLIATIVE TREPHINING IN CASES OF TUMOR OF THE INFUNDIBULAR REGION. S. P. KRAMER, M.D., *J. Nerv. & Ment. Dis.* **48**:353 (November), 1918.

Kramer reports four cases of tumor of the hypophysis in which pressure symptoms were relieved by palliative operations, namely, by turning back a large frontal flap and freely incising the dura, then folding the bone flap back and suturing the skin.

Kramer deplores the use of the word "decompression" as furthering the idea that relief of increase of intracranial pressure may be produced by operation on any part of the skull—with which he entirely disagrees. He insists that the purpose of palliative operations is to relieve pressure in the nerves of the base of the brain—particularly on the optic nerves—and believes that the frontal bone method is the most favorable sight for this operation.

WEISENBURG, Philadelphia.

SOME EXPERIMENTS BEARING ON THE FLOW OF LYMPH IN NERVES. L. B. ALFORD and S. I. SCHWAB, *J. Nerv. & Ment. Dis.*, **47**:118 (February), 1918.

The hypothesis that there is a flow of lymph in nerve trunks in a central direction has been used to explain the location of the lesion in the nerve roots in tabes, herpes zoster and some other affections, and also to explain some of the phenomena seen in rabies, tetanus and poliomyelitis. This hypothesis has received some experimental confirmation by Orr and Rows, Pironne, Laitiner and others. In attempting to confirm these results, the authors injected a solution of certain iron salts, and of fuchsin, India ink, turpentine and ether into the nerve trunks of animals but found no evidence of the existence of an ascending lymph stream. It was found, however, that when certain substances, particularly turpentine and ether, were injected into nerve trunks, they flowed along under the sheath for long distances and entered the subarachnoid and subdural spaces. This fact and not the presence of an ascending lymph stream may account for the results of other observers. It was also found that ether injected into the infra-orbital nerve in the cheek passes into and causes a degeneration of the Gasserian ganglion. It is suggested that this method might be used in the treatment of trifacial neuralgia.

It would seem to the reviewer that if lymph channels existed in nerve trunks they might be supposed to be of such a delicate type that the traumatism produced by the injection of any foreign substance, and the consequent inflammatory reaction, would most effectually block these channels and so stop the flow that the experimenters were endeavoring to determine.

CAMP, Ann Arbor, Mich.

CLINICAL STUDY OF THE ORIGIN, DEVELOPMENT AND DISAPPEARANCE OF A SYSTEM OF DELUSIONS. L. E. EMERSON, M.D., *J. Abnorm. Psychol.* **13**: pp. 23-32.

The case is a woman (age is not given) who presents marked delusions of reference (ministers preach at her, sermons published about her, people look at her, talk about her among themselves). This because she is regarded

as immoral on account of her obsession to look at the genital region of men. She was quite depressed about the situation and was anxious to convince her friends that she was not bad but only troubled by a habit she could not control. Emerson gives the following analysis: The patient was a woman of powerful passion ("when I want anything I want it so terribly that I am afraid"). In this respect she is like her mother, but in order to be totally different from the latter she repressed her instinctive feelings. She hated her mother. This as well as the fear of her own desires, Emerson thinks, made her dislike to be a woman. She therefore began to act like a man and wanted to dominate every situation. The patient once dreamed that she was a man. As a result of this struggle she became nervous and the obsession commenced. At this point she wanted advice, but would not go to a man for fear he would take advantage of her and went to a woman for advice. She fell in love with this woman, and the latter becoming frightened repelled the patient. She was now thrown on her own resources and developed the delusions. Emerson says that her libido was now blocked in every way, that she had no outlet in any intellectual life to which she felt she could rise, could not love a woman, nor could she love a man (because it was dangerous). Moreover, she did not want to love a man but to *be* a man. Emerson says her love instinct or her desire to receive and give affection then "degenerated into the obsession of looking and then into delusions."

She began to recover when she became willing to talk and to understand the situation. But the cure came chiefly when she fully appreciated how intense and at the same time how much repressed her desire to be a man really was.

To the reviewer the case illustrates again the fact that an analysis to be therapeutically helpful need not be very thorough but that it merely has to formulate the situation for the patient in such a manner that it can be dealt with, no matter how comprehensive or one-sided this formulation may be. This of course is also the reason why a therapeutic result of an analysis by no means shows that the formulation was entirely correct. The therapeutic accessibility in this case may also depend on the fact that there was considerable depressive affect and that the delusional development was merely superimposed on an obsession and was even in consciousness not entirely cut off from this source.

Hoch, Santa Barbara, Calif.

Society Transactions

PHILADELPHIA NEUROLOGICAL SOCIETY

Regular Meeting, Dec. 18, 1918

MAX BOCHROCH, M.D., *President*

A CASE OF SYPHILIS HEREDITARIA TARDA, WITH "TIP-TOE" GAIT. DR. N. S. YAWGER.

The patient, who is from the service of Dr. Lloyd at the Philadelphia Hospital, is a girl, aged 10 years. The case is of some interest by reason of the tardy development of transmitted syphilis, but more particularly because it shows a very remarkable gait.

Present Trouble.—At 6 years this child began school and two weeks later she said her feet felt as though pins and needles were sticking in them; these pains kept up for a month and then she began to walk on her toes. Her behavior at this time was like that of other children—she talked, played, sang and recited pieces. At 8 years her speech became affected, she showed some disturbance of vision and was becoming noticeably deficient mentally. About six years ago, she developed epileptoid attacks; these occur once or twice in twenty-four hours and last from one to three minutes. In behavior she is irritable, bad-tempered and cannot be easily disciplined; if crossed, she gets into a tantrum—screams, kicks, bites and beats her head and body.

Previous History.—She was born at term and her infancy and early childhood was uneventful. She had a good start and apparently was a healthy child.

Family History.—The father is a laborer of about average intelligence and nonalcoholic. He admits a previous gonococcus infection but denies syphilis. The Wassermann test in the blood is negative. The mother died a few years ago—cause unknown. There had been but one pregnancy.

Examination.—Mentally, this girl is an imbecile; she is emotional, demonstrative and affectionate.

Station.—When standing her feet are rather widely apart and rest squarely on the floor; there is a backward bending of both knees, particularly the left.

Gait.—The child walks as though her extremities were rigid and usually, though not invariably, walks on her toes; she can keep up this gait for a considerable time and even run; the "tip-toe" gait is not due to talipes equinus; it is not constant, and she is not spastic.

Eyes.—There is no nystagmus nor ocular palsies. There is evidence of previous ulcers in the scars on the corneas. The pupils do not respond to light nor in accommodation.

Upper Extremities.—Judging from her volitional movements, they do not seem ataxic. The muscular power is good and the biceps and triceps jerks are equally and bilaterally exaggerated.

Lower Extremities.—These appear almost overdeveloped, both being unusually strong. At times, there is a bilateral patellar clonus; the patellar and

Achilles jerks are markedly exaggerated but there is no spasticity. There is an absence of ankle clonus and Babinski's sign. The sphincters are intact.

Sensory Changes.—Apparently there are none. She has typical Hutchinson's teeth and scaphoid scapulae. The Wassermann test in the blood was negative; two attempts at lumbar puncture gave no fluid.

Roentgenograms.—These were made from the lumbar spine and the knees; all were negative.

DISCUSSION

Dr. J. HENDRIE LLOYD said that this child had been observed by him in the Philadelphia Hospital. Dr. Yawger had already called attention to all the features of the case. She has Hutchinson teeth very marked, and she has a rather characteristic history of the development of nervous trouble after she was born. She seems to have been a healthy child in early infancy and to have developed physical and mental deficiencies later on. That was in line with the history of hereditary syphilis as Hutchinson called attention to it many years ago. That is to say, the child may be born apparently perfectly well, and with the exception of some sniffles and some sores about the corners of the mouth and a transient keratitis, it may be practically a well child until 6, 7 or 8 years of age, when it begins to develop serious nervous disorders, such as epilepsy, paralysis and idiocy. This child has developed the ordinary appearance of the disease. The affection of her lower limbs, however, is peculiar. Her limbs are not spastic. She is fairly limber in her legs, but when she begins to run, up she goes on her toes as though by some spastic contraction of the muscles. She has quite typical Hutchinson teeth; also retarded mental development. The fact that the father has a negative Wassermann reaction and that the child has a negative Wassermann reaction has little or no significance. Dr. Lloyd believed in hereditary syphilis; it was commonly found that the child did not have a positive Wassermann in the blood or spinal fluid. This case raised the question as to what we mean by hereditary syphilis. According to the present-day biologists nothing can be hereditary which is not transmitted through the germ plasma. No acquired deficiency or deformity can be transmitted. That being so, and since we discovered that syphilis is a spirochetal disease, the question arises: Is there such a thing as hereditary syphilis? Biologists tell us that the spirochete is larger than the spermatozoon, it is larger than the ovum. If that is so, how can the spirochete get inside the spermatozoon? How can a spirochete be transmitted through the germ plasma? Hutchinson wrote of syphilis with remarkable prevision thirty years ago. He knew nothing about syphilis being due to a micro-organism, but he believed it was. He referred to the fact that some writers refuse to believe that hereditary syphilis can be transmitted from the father because of this very difficulty of seeing how the micro-organism could be transmitted through the spermatozoon. If that is true, hereditary syphilis is a misnomer. What we have in these children is acquired syphilis—acquired in embryo through the mother. In other words, it is congenital syphilis. Dr. Lloyd thought this child showed clinically fairly good evidence that she presents a case of retarded congenital syphilis.

Dr. CHARLES W. BURR said that he had seen quite a few imbecile children who had very curious gaits that were not due to an organic disease, but were mental. They were habits that the child had acquired, and he rather doubted whether in Dr. Yawger's case the gait had an organic basis. Of course, the child was an imbecile and a syphilitic and all that, but Dr. Burr

was not convinced that it was due to a gross disease in the cerebral cortex. He would be inclined to believe, until the postmortem comes, that this was a trick in walking that the child had acquired. Imbeciles are very prone to all sorts of tricks, grimaces, dancing, etc. Dr. Burr thought it was quite possible that this condition instead of being a physical thing—he said he was speaking now of the gait rather than of other symptoms—that the gait may be mental rather than due to gross organic disease.

DR. AUGUSTUS A. ESHNER said he wondered whether one had not a right to ask for better evidence as to the syphilitic nature of this case? He thought that so-called Hutchinson teeth were not an infallible evidence. They were observed in association with other nutritional disorders, as has been shown. In the absence of the Wassermann reaction in the child and in the father, it seemed to be taking a liberty to describe this as a case of syphilis. The evidence was against syphilis rather than in favor of it.

DR. ALFRED GORDON said that the manner with which she stepped on her toes in order to walk reminded him of cases of extracapsular lesions. It resembled in one respect a case which he had named extrapyramidal hemiplegia and which he had exhibited before the Society. The moment the man attempted to move his hand, immediately there would be marked rigidity and spastic contraction of the extensor muscle. If he did not attempt to exercise the muscle the arm remained in exactly the same position as before. The moment an attempt was made to touch him or make active and passive movements, immediately the arm became rigid. When the child attempts to walk the flexor muscles of the legs become rigid. Here is a child mentally abnormal, which suggests some malformation of the central nervous system. The question in Dr. Gordon's mind was whether the extrapyramidal area was constitutionally abnormal so that stimulation of it produces rigidity of muscles controlled by that area. In regard to Dr. Lloyd's remark about hereditary syphilis, Dr. Gordon asked him to recall some facts reported in the literature in which some very young children supposed to have hereditary syphilis, had their spinal fluid and blood inoculated into animals, and spirochetes were found in the testicles. Dr. Gordon said he would then believe that even in the absence of the possibility of finding directly spirochetes in children they may be syphilitic through heredity.

DR. NATHAN P. STAUFFER said that if a nose and throat specialist might be permitted to ask a question, he had been wondering whether this child might have this trouble from infantile paralysis. The reason he asked was this: He had under his care some boys and at the time of the epidemic one of them died from the respiratory type of infantile paralysis and a number of boys who were in contact with that boy, and whom Dr. Stauffer was positive did not have disease of the vocal chords before, have since shown paralysis of the vocal chords. He wondered that in a number of the cases we see in which we are in doubt as to what causes the condition if the cases may not be due to infantile anterior poliomyelitis.

DR. G. LANE TANEYHILL remarked that apropos of a negative Wassermann in the blood serum in this patient (the mother not having been examined), this fall he saw a boy, aged 15 years, who is the physical size of a boy of about 11 years, and who had an undoubted case of *tabes dorsalis*. One of two undoubted juvenile cases of *tabes* Dr. Taneyhill has seen. The Wassermann was negative in the blood serum both before and after eight injections of arsphenamin, but the spinal fluid was positive—with 33-cells positive Wassermann reaction—and the colloidal gold reaction gave the paretic curve.

Both father and mother were examined; they revealed no signs of nervous disease and they cooperated far enough to have a Wassermann test made, but it was negative in both of them; but the spinal fluid of neither the father or mother had been examined. He thought it was very desirable to have the spinal fluid obtained from this child. That the blood Wassermann was negative did not exclude nervous system syphilis.

DR. N. S. YAWGER in closing the discussion, said in regard to the condition having resulted from infantile paralysis—unquestionably, the cerebral form could give rise to some of these symptoms; but here, the onset was slow and the child had many symptoms common to congenital syphilis including Hutchinson teeth, scaphoid scapulae and scars on the cornea. As to such teeth, these are typical of what Hutchinson described. It has already been remarked that a negative Wassermann is by no means uncommon in congenital cases. The comments by Dr. Burr on the gait, conform more nearly to what Dr. Yawger had in mind. Dr. Yawger had already remarked that the lower extremities were strong—appearing almost overdeveloped. Despite negative roentgenograms of the knees, there was an obvious defect at those joints, and he was inclined to believe that the gait was largely one assumed by the child to overcome the weakness at the knees.

A CASE OF MEDIAN NERVE INJURY, DUE TO STAB-WOUND
FROM ULNAR SIDE OF HAND. Presented by DR. T. E. SHEA
(by invitation).

Summary of Case.—The case presented is peculiar from the fact that a stab-wound in the hypothenar or ulnar side missed the ulnar nerve and injured the median. After a process of anatomic deductions, the injury was located in the median nerve at its emergence from under the anterior carpal ligament. Physiologically considered the deduction was made that the superficial fibers were injured, as it involved mainly the sensory distribution. Trophic disturbances were present which lead to thoughts, concerning the great factor displayed by normal nerve force in infections. The trophic disturbances in this case were compared to the limited gangrene of diabetes mellitus, and the belief expressed that ordinarily infection could not progress unless toxins destroyed the nerves controlling the protective forces of tissue.

DISCUSSION

DR. J. HENDRIE LLOYD said that trophic lesions following injuries to the median nerve had been reported. A case was reported some years ago by Haldor Sneve in which injury to the median nerve was followed by painless whitlows on the ends of the index and middle fingers resulting in loss of the distal phalanx in each of these fingers. Dr. Lloyd thought that was one of the risks in this case. Motion is not so much impaired in injuries to this nerve as might be expected.

DR. CHARLES S. PORTS said that he was considerably interested in the trophic disturbance in this boy's fingers because he had seen two cases of injury to the median nerve in which there was great liability to trophic ulceration in the skin area supplied by this nerve. In one of these cases a blister appeared on the end of the thumb. It finally dried up and left an area of sluggish ulceration which was very slow in healing and only did so as the other symptoms improved. The nerve was not divided, but injured.

Dr. Potts inquired if injuries to the median nerve were more likely to cause trophic disturbance of this sort than injuries to other nerves. Dr. Potts had also seen a woman the other day in whom an injury to the median nerve had caused symptoms similar to those of this man, and she had a little blister on one finger which looked as though it would break down and ulcerate.

DR. FRANCIS X. DERCUM said that one thing that would account for the freedom of escape of the ulnar nerve was the fact that it lies more superficially than the median. The knife entered well into the body of the hypothenar eminences and in that way the ulnar nerve lying practically above this level it escaped. The interference with the ulnar was very slight, if indeed any. Dr. Dercum asked the patient how much pain he noticed when it happened, and the patient replied, "No pain at all. My whole hand was numb."

DR. T. E. SHEA, in closing the discussion, said that in speaking of this case he had drawn the differentiation between the sensory and the motor fibers. Some authorities, which at the present time he could not quote, claimed that the superficial fibers of the nerve trunk were purely sensory fibers, while those which lie deeper were the motor fibers. If that particular fact held true the cut must necessarily have simply affected the superficial fibers of the nerve trunk. Speaking of the trophic disturbances, he mentioned the fact and asked what part the nerve force played and whether the trophic disturbance in this particular nerve involvement was not something like the diabetic gangrene we see.

HYSTERIA WITH MULTIPLE OPERATIONS. Presented by DR. FRANCIS X. DERCUM.

Previous History.—The patient was a woman, aged 27, from the wards of the Jefferson Hospital, and gave a history of five major operations for the relief of pain, none of which had been successful. The patient was unmarried; housemaid by occupation. No facts of importance were elicited in the family history. She had suffered from the ordinary diseases of childhood, had begun menstruating at the usual time, but at 17 had been nervous and had frequently suffered from convulsive seizures. At this time (1908) an appendectomy was performed. Subsequently (1910), a laparotomy for the removal of an ovary; in 1912, a gallbladder operation was performed. In 1915, an operation was performed for nephropexy, and in 1917 this operation was repeated.

Present Symptoms.—The patient presented no evidences whatever of any organic nervous disease nor of any visceral disease. While at the hospital, she had suffered repeatedly from hysterical convulsions and had complained of severe pain in the right side of the abdomen. At times, this was referred to the groin, to the right side of the abdomen. At times to the right lumbar region.

Examination.—This revealed marked areas of cutaneous painful hyperesthesia, but no tenderness or pain could be elicited on deep pressure. While Dr. Dercum could not, of course, claim that the operations performed had not been necessary, the patient herself stated that the symptoms from which she suffered had not been in any way relieved. It is more than probable that the pains of which she had complained and which had stimulated possible visceral disease had been purely hysterical in nature.

DISCUSSION

DR. CHARLES W. BURR said he thought it was a very common thing for hysterics to be operated on. Indeed, he sometimes thought that there were some surgeons who had no conscience at all. Also, in organic disease Dr.

Burr said he fancied that every man present had had at least one case of locomotor ataxia which had been operated on. At the Orthopedic Hospital about every eighteen months a patient comes to show a scar of an operation which was done in perfect good faith.

DR. SHERMAN F. GILPIN said that he had recently seen a patient who had been frightened in school at 14 and lost her voice. Since then she had had seven abdominal and two nose and throat operations in twelve years.

DR. ALFRED GORDON said this question of useless operations was very common. It was so ordinary that you look for it and as far as the conscience of the surgeon was concerned he would rather say that it was not their fault mostly. The patient is directed by the general practitioner to the surgeon with request for operation. The patient complains of pain in the abdomen. They find anteversion and all sorts of abnormal conditions of the uterus and refer all nervous trouble to that, to movable kidneys, to gastropnoxis and accordingly the patient is operated on; after the operation he is just the same as before. Dr. Gordon remembered one case several years ago which impressed him so much that he could never forget it: A young man of splendid appearance, who made the rounds of the hospitals for pain in the abdomen was treated in many ways. All sorts of diagnoses were made—dilatation of the stomach, and many others. He was massaged, even sounds were passed, cystoscopy was performed, and one surgeon advised the removal of part of the colon. Finally, he developed pain in the right side of the hypochondrium and was referred to a prominent surgeon who advised an immediate operation. Later in the evening the patient was put on the table; the patient being very emotional and excitable, saw the surroundings, physicians with white aprons and coats and instruments around. He became frightened, and jumped off the table and ran away. From that time he never had a pain.

DR. FRANCIS X. DERCUM said that he felt that his experience was not unique in this particular matter because there must be frequently recurring cases with multiple scars. Still, we must be very careful in regard to what we do and say. Dr. Dercum remembered many years ago when Dr. Osler sent him a patient who had an interesting case of abdominal pain. The man had pain in the epigastrium. He had been studied at the Johns Hopkins Hospital without any very definite result. He had acquired the morphia habit because of the pain, and when the man was sent to Dr. Dercum he withdrew all morphia, and then the patient became more than doubtful as to whether he had not a real organic basis for his pain. Dr. Keen operated and a small ulcer was found over the wall of the stomach. That man had an actual cause for his pain. That was not a case of hysteria. The diagnosis lay between tabes with gastric crises or gastric ulcer. Dr. Dercum finally persuaded him to have an exploratory operation performed. Dr. Dercum said he did not believe in exploratory operations as a rule. He thought this frequency of exploratory operations in nervous cases was a very serious matter.

TWO CASES OF FRIEDREICH'S ATAXIA APPEARING VERY EARLY IN LIFE. Presented by DR. FRANCIS X. DERCUM.

Dr. Dercum also exhibited two boys—brothers—aged 6 years and 4 years, respectively, both presenting the symptoms of a typical Friedreich's ataxia. The patients had been referred to Dr. Dercum's wards of the Jefferson Hospital by a nearby charitable institution.

Previous History.—The family history that could be elicited was rather scanty. However, it was learned that the father is living and is about 35 years of age; that he was unable to walk alone until about 9 years of age; that he comes from a strongly alcoholic family and is himself an alcoholic. Even when sober, he is said to walk as though intoxicated.

Present History.—The personal history of the older child is as follows: He has been apparently in good health aside from his present affliction. The patient had been abandoned by his parents in the early months of life and has been cared for in a public institution. He has only begun to walk during the past eighteen months. His gait is markedly ataxic; stands with his legs widely separated, and sways as though about to fall. The knee jerks are lost; there is a faint Babinski reflex on the left side, but no other feature of moment. The younger patient, aged 4, presents symptoms very much like those of his brother and equally pronounced; loss of knee-jerks, but no Babinski sign. Both of these cases are of interest because of the unusually early age at which the symptoms have made their appearance.

X A CASE OF TABES DORSALIS SHOWING RESULTS OF TREATMENT, INCLUDING DRAINAGE OF CEREBROSPINAL FLUID. Presented by DR. SHERMAN F. GILPIN.

This was a case of tabes dorsalis, showing effects of treatment by inunctions of mercury, with drainage of the cerebrospinal fluid.

History.—The patient, Mrs. A. K., a white woman, aged 49, was admitted to the Jefferson Hospital clinic in June, 1917. She is the mother of six living children and all of them in good health. Her present illness began four years ago with pain in left leg. Shooting pains in arms, neck and face have been marked.

Examination.—Physical examination shows typical Argyll Robertson pupils, diminished knee-jerks, and ataxia of gait and station. The ataxia was well marked and the patient so ill and weak it was necessary that some one accompany her on her visits to the clinic.

Laboratory tests on admission showed: Blood Wassermann, +; fluid Wassermann, + + + +; lymphocytes, 48. Laboratory tests in March, 1918, showed: Fluid Wassermann, + +; lymphocytes, 43. During the last three months several Wassermann tests of the spinal fluid have been negative and no lymphocytes were found except at the last examination when the report is 4 cells per cubic millimeter.

Present Condition.—At present the patient feels well, has gained weight, stands well with the eyes closed and can walk the streets as well as she ever could. She has used mercury by inunction faithfully to the physiologic limit. Her spinal fluid has been drained thirty times.

DISCUSSION

DR. FRANCIS X. DERCUM said that it seemed at first sight difficult to account for the benefit of drainage in tabes and paresis. It occurred to Dr. Dercum that the explanation was as follows: If the pressure in the dural sac is increased, it must mean that less blood can flow into the cord than normally. If the pressure be suddenly reduced, a passive hyperemia of the cord probably ensues. You have here a method which is comparable to the Bier method in surgery. In the second place, if the spinal fluid is drained thoroughly, toxic

bodies must also be removed. Dr. Dercum said they took away 50 or 60 c.c. with great benefit. He was quite sure some of these patients would get much better even without the inunctions, just from drainage itself.

DR. GILPIN, in closing the discussion, said that Dr. Dercum had answered a question by Dr. Burr. He drained all the fluid that would run out. A week or two ago he took the fluid from a case of tabes for another physician and in a couple of days he reported to Dr. Gilpin that the patient was deaf. Dr. Gilpin saw her the next day. He could not make her understand by yelling in her ear. In three days she had recovered. Another thing—in taking fluid from a tabetic there is no following headache, whereas in the nonsyphilitic the patient has severe headache following spinal fluid withdrawal.

NYSTAGMUS ON MONOCULAR VISION. Presented by DR. ALFRED GORDON.

History and Examination.—A girl, aged 16, commenced to complain of poor vision six years ago. She improved under some treatment. Several months ago there was a return of the condition. When she came under the author's observation, the following symptoms were noticed: On monocular vision nothing abnormal was present. When one eye was covered the other eye immediately assumed the state of lateral nystagmus with the quick movement externally. Moreover, when the patient having both eyes uncovered would turn them externally to the extreme angle, either eye could not remain fixed in the external angle but would tend to move away. The pupils and eye-grounds were all normal. The patient also presented some atasia of the left hand in the pointing test and diminished knee-jerk on the left side.

Treatment.—Although the Wassermann reaction of the blood was negative, nevertheless, she was placed on mercury and iodids. There was considerable improvement in the power of the external recti muscles to hold on when the eyes were placed in the extreme external position, the atasia of the hand disappeared totally. The nystagmus on monocular vision remained unaltered.

Comment.—The condition of the eye-globes—namely, the nystagmus and the inability of the external recti to remain in a fixed position—point either to a congenital weakness of the latter muscles or to a lesion in the muscles of both sixth nerves.

DISCUSSION

DR. FRANCIS X. DERCUM said that the little girl looked to him as though she had rather prominent eyes, rather a large thyroid, and rather a rapid pulse. Have we not, perhaps, here a case of hyperthyroidism or exophthalmic goiter associated with the nystagmic involvement?

DR. WILLIAM G. SPILLER said that in examining the patient he had observed a phenomenon which Dr. Gordon had not mentioned. Dr. Gordon had stated that the external recti muscles were weak, but Dr. Spiller had noticed that this weakness like the nystagmus was distinct only in monocular vision. When the girl looked to the right or left with both eyes opened the weakness of the external recti muscles was not evident, but if she closed one eye the outward movement of the other eye was very imperfect and the eyeball could not be held well in the outer canthus. It was evident that the innervation of each external rectus muscle in binocular vision was greater than in monocular vision, and probably the innervation of the internal rectus muscle of one eye

caused an overflow of innervation to the external rectus muscle of the opposite eye. While this double innervation might occur to some extent with one eye closed, it was greater with both eyes open, and was then sufficient to overcome the slight weakness of the external rectus muscle, which possibly was congenital.

The nystagmus occurred under precisely the same conditions, and it was reasonable to associate one phenomenon with the other. The nystagmus occurred only in monocular vision probably because of the weakness of the external rectus, which being slight did not prevent the eyeball from moving outward, but was sufficient to prevent it from being held firmly; and in the attempt to fix the eyeball repeated innervation was necessary and a pseudo-nystagmus was thus produced. A pseudo-nystagmus may readily be observed in a person looking out of the window of a rapidly moving train, as the eyes are rapidly losing from vision the object fixed and a new object is equally rapidly coming into the visual field.

DR. G. LANE TANEYHILL said that he would suggest that the weakness of the external rectus was not sufficient to give the patient a squint. It was weak only enough to cause a little swinging inward on monocular vision which she tried immediately to correct, producing "nystagmus." This suggestion accepts Dr. Spiller's observation.

DR. DERCUM said that nystagmus was a positive sign. It was not a sign of mere muscle weakness. A muscle may, at times, present a nystagmoid movement which comes to rest after a while, but is a positive symptom.

Book Reviews

THE PSYCHONEUROSIS OF THE WAR. By DR. G. ROUSSY, Assistant Professor in the Faculty of Medicine, Paris, and J. LHERMITTE, sometime Laboratory Director in the Faculty of Medicine, Paris.

Translated by WILFRED B. CHRISTOPHERSON: Edited with a prefatory note by WILLIAM ALDREN TURNER, C.B., M.D., Temporary Colonel, Army Medical Service and Consulting Neurologist to the Forces in England. Published by the University of London Press, Ltd., in the Military Medical Manuals.

To the neurologist, especially one who has taken up military duties, this will prove one of the most interesting books resulting from the war. The psychologist will perhaps be disappointed that the authors do not go more deeply into the mental mechanisms involved in the production of these conditions, although no one will doubt for a moment their practical understanding of the underlying mechanisms when the results of their treatment are considered.

One of the fundamental elements in the causation of the psychoneuroses is certainly emotional shock but this alone does not suffice to produce the symptoms. In the normal individual, emotional phenomena, however violent they may be, are restrained by force of will by personal self-control; then, when the emotional cause has ceased to act, they fall into oblivion, effaced by the perceptions, the preoccupations and the associations of daily life.

In the neuropathic subject the war brings an almost continual recrudescence of these emotions, which added to bodily fatigue, begets in one already predisposed "a highly emotional condition and emotional receptivity."

The initial emotional condition is not necessarily followed immediately by psycho-neuropathic symptoms; a latent period—a period of incubation—is interposed between the causal emotion and the onset of these symptoms. The soldier profoundly impressed by the conditions and often experiencing the most distressing visceral disturbances from the emotion, reacts, driven by that instinct deeply rooted in us all—that of self-preservation. Shaken by a bursting shell, for example, he has nevertheless the energy to escape from danger. Far from being glued to the spot, he shelters in a dugout, a shell hole or a trench. It is when removed to calmer surroundings, far away from danger, that the psycho-neuropathic condition comes to light, whether as a contracture, a paralysis, a tremor, or a convulsive fit.

Exception might be taken to the authors' statement that "this is easily understood if we bear in mind that from the moment when all danger is passed, the instinct of self-preservation loses all its inhibiting influence over the emotional phenomena," and "we thus reach the third act of the series, the fixation and realization of the emotional reaction." One would say rather the emotion is the natural reaction to the stimulation of the instinct of self-preservation, and it is the will-power alone influenced, it is true, by the instinct which exerts the inhibitory restraint over the emotional reaction. The individual having reached a place of comparative safety has a free opportunity to react fully to the emotion; during which emotional reaction the action of the higher intellectual processes which normally govern the will-power and self-control are disturbed or altogether in abeyance, and the desires incited by

the instinct of self-preservation hold sway. During the period of inactivity of the higher intellectual processes any auto-suggestion or hetero-suggestion which agrees with the desire present is accepted, and so we reach the development of the psychoneuropathic manifestation, be it a contracture, a paralysis, a tremor or a convulsive fit, mutism or delirium. It is not the "restraining bridle rein of self-preservation" being no longer present which allows this fixation and realization of the emotional reaction, but it is precisely the desires set up by that same instinct of self-preservation in the absence of the activity of the intellectual censor which incite this psychoneuropathic manifestation; otherwise, why do we not see similar manifestations in German prisoners, and why do the Germans remark on the absence of these same manifestations in our men whom they have captured? Surely in them the restraining bridle rein of the instinct would be removed, or at least very considerably loosened.

This is by no means a distinction without a difference, because, if my view be correct, it immediately puts into our hands a reasonable and practical method and guide for treatment; whereas if the authors' interpretation is right then it is impossible to explain the rationale of their method of treatment except by inferring that they by their electrical applications excite the instinct of self-preservation to such an extent that it again puts on the restraining inhibiting influence. This I do not believe.

My interpretation of the successful results reported by the authors is that the patient is put in such a position that his desires are guided into proper channels and an incentive is given him to have the will to control his psychopathic disability.

The authors lay stress on the fact that the faradization must be continued until the patient is "mastered," which, as I have analyzed it, means until a negative self-feeling is inspired in him which will render him more suggestible and more amenable to reason.

The book increases in interest as we proceed: detailed description is given of all the varied characteristic forms of neuro-psychopathic disability, and one is struck with the similarity of the experiences of those in the French army to what neurologists in other armies have described. The writer has seen instances of every type the authors describe but cannot add any types that they have omitted.

The chapter on the predisposing and exciting causes leaves little to be added. The exact method of treatment will vary according to the personality of the physician. The chapter on this subject should be of great assistance, and should be followed with an intelligent appreciation of the object aimed at.

I think one will find that as he gains in experience and, what is perhaps more important, creates an atmosphere of optimism, faith and cure, he will resort less and less to the use of the faradic current and depend to a greater extent on the other parts of the methods outlined—namely, the preliminary careful general examination, then the sincere sympathetic explanation of the true cause of the development of the symptoms followed by verbal persuasion to complete cure. Isolation during this period is certainly a useful adjunct to the treatment.

The appreciation of the fact that the physical disability is merely an outward evidence of the underlying mental disturbance renders a more or less prolonged course of physical and psychical reeducation with occupational therapy necessary. "The cure of a psycho-neuropath really consists of a mental contest, resulting in the victory of the physician. This, in conclusion, is the secret of psychotherapy."

The final chapter is devoted to the military decisions affecting the disposal and pensionability in these patients. These decisions were inspired by the Neurological Society of Paris and will justify the serious consideration of the military medical authorities of the Allied Armies. I may say they have been adopted in the Canadian Army and are proving eminently successful. The rationale of these decisions I think will be found to conform to the interpretation which I have attempted to advocate in the above lines.

COMMOTIONS ET ÉMOTIONS DE GUERRE. Par ANDRÉ LÉRI.
Paris, 1918.

This booklet is one of the well known series of French medical war manuals, "Collection Horizon," published by Masson et Cie.

Much of what has been written on the subject of "shell shock" has been based on incomplete experience. This is true not only of publications which appeared early in the course of the war, but also of later publications, the latter having been produced for the most part by medical officers working not in the zone of the advance but in neuropsychiatric centers where they could see only cases evacuated to the rear, and these but in the later stage of their course. These cases constitute a small proportion, and are not representative of the total.

The same is not to be said of the work under review. The author had witnessed war neuroses at the front, in field hospitals, and in neuropsychiatric centers in the interior, and presents a summary of his observations in the light not only of his own four years' experience, but also of the views of other observers.

The principal message of the book seems to be to point out the heterogeneity of "shell shock" and particularly to draw the distinction between true concussion and purely emotional disorders. Among other subjects treated are cerebral contusion, focal traumatic lesions, war psychoses, and hysterical disorders.

In an introductory chapter the questions are raised: Can one, on the battlefield, in the first aid station, in the field hospital, or in the base hospital, distinguish a case of concussion from one of emotional disorder? Of what importance is it to make that distinction? The answers given are: At the front, cases of concussion and of emotional disorders behave differently; the first effects having passed, the symptoms are still distinguishable on the patients' evacuation to the rear, and even later the sequelae following the two conditions are often different in aspect and course; these differences should be recognized, as the treatment of the two conditions is as dissimilar as their general course and their immediate and ultimate prognosis.

Cases of concussion vary in their clinical aspect. Five general types are described as follows:

1. A large shell bursts overhead or a bomb drops in a trench and explodes at a distance of a few meters from a soldier. He is thrown violently, unconscious. He may die without a movement or a cry, though not touched by a fragment. This may be termed *fulminating concussion*.

2. If death without wound is relatively rare, *immediate loss of consciousness* is, on the contrary, the rule. The soldier falls where he may happen to be, perhaps in full exposure to barrage; there he remains regardless of danger. He is taken up and carried to the first aid station either on a litter or by his arms and legs. He is inert, arms and legs hanging or swinging, body sunken, head hanging, chin on chest. On examination, he is completely unconscious, limp, his face pale or, more often, cyanotic; often he bleeds from the nose or

ears. If the examiner raises a limb and then lets go, it falls heavily like a dead weight; if pricked or pinched the soldier does not stir. He responds to no question. All tendon reflexes are abolished or greatly diminished; *the pupils are widely dilated* and react but very slightly to light; *the pulse is slow* and weak; respiration is slow and stertorous. The patient is often soiled with urine or fecal matter—sometimes with vomited matter.

3. In other cases, the patient, instead of being an inert mass, presents a certain rigidity; the limbs are not limp, the head does not hang. When an arm or leg is raised it does not fall back so heavily; if the patient is pricked or pinched he will groan and withdraw the limb; if spoken to in a loud voice or if shaken by the shoulder, he will answer, always slowly, painfully, in monotonous fashion in monosyllables, in stereotyped words, but nevertheless distinctly and correctly without confusion. Thus one patient responded to all questions with the words *head, shell, cold*; but these words were not used at random, but with perfect relevancy to the questions put to him. The limbs may be animated by semiconvulsive trembling. All tendon reflexes are increased, sometimes unequally on the two sides.

4. In still other cases the patient likewise falls where he may be, a complete stranger to the instinct of self-preservation. Often he, too, is lifted by stretcher bearers, but he can to some extent support himself, and he is brought to the first aid station by being supported under the arms. If released on the way he tends to fall again. Every movement is extremely painful and the feet seem to drag a weight at each step. At the first aid station he, too, lies inertly where he may be left; but he groans, complains if made to move, answers questions, complains of headache. However, he does not know where he is, nor why he is there, nor what has happened to him, and, when the questioning is discontinued, falls back into his inert, clouded state, indifferent to his surroundings. Here, too, the pupils are generally dilated and the pulse slow.

5. Finally, in a small group of cases, the soldier, more or less stunned by the shock of a violent explosion, but not thrown, presents signs of lesions in the nervous centers—organic paralyses, aphasia, jacksonian convulsions, blood in the spinal fluid—but *no loss of consciousness*.

An interesting group of cases occurred under the following circumstances. A 90 mm. gun was partly concealed in a hole about 1 meter in depth and about 4 meters square. To the left, in a small dugout four artillerymen were seated in a row. A large shell fell to the right of the gun, exploded, and turned the gun over on its left side. Of the four men, the two nearest the opening of the dugout were found dead, still seated, with faces swollen and livid, blood running out of their nostrils and ears; they had no wounds. The third was drowsy, immobile, but was breathing well and answered questions in monosyllables; he was wounded in the arm; he was brought out, his wound dressed, and he was evacuated to the rear. The fourth was in the farthest end of the dugout; he, too, was brought out; in the fresh air he seemed inert for a few seconds; then while his comrade's wound was being dressed, he suddenly stood up and ran away as fast as his legs could carry him. Thus, side by side, according to the distance from the point of the explosion, in a dugout but $1\frac{1}{2}$ meters in depth, there was death from concussion and the clinical pictures of concussion and emotional disorder.

The emotional disorders are in striking contrast with concussion. Whether in more or less close proximity to a large shell, bomb, or mine explosion, or at a good distance from a projectile of large or even small caliber; whether he had witnessed, even from afar, some terrifying scene in which explosives

have played no part; whether thrown or not; in any case, *the patient has not lost consciousness*. If thrown, he quickly gets up again; if going forward, he turns back, and that quickly, if possible at a run, or else limping or staggering, and arrives *alone* at the first aid station. With haggard look, pinched nose, pale face, wild expression, he throws himself into the farthest corner of the first aid station, sits down on the ground or on a bench, all huddled up, and does not budge.

An attempt at examination finds him incooperative, trembling, rigid; respiration panting, *pulse rapid* and strong, pupils *rather small*; but the tendon reflexes are neither increased nor diminished, the pupils react well to light, patient is not wet or soiled.

He will not answer questions; seems not to hear, to be mentally absent. This is the same subject who, the next day, in the field hospital, or later, in the base hospital, will say, though in good faith, that he had lost consciousness and can recall nothing. In reality he has not lost consciousness and can recall everything perfectly; one needs but know how to question him; but in the meantime he is *exclusively preoccupied with his anxiety*, indifferent and inattentive to everything save that which concerns the instinct of self-preservation.

In the first aid station the patient will not locate himself at random. He will look over the ceiling and the walls and often quickly change his place for greater security.

When the ambulance comes to evacuate the wounded, these men, who seemed incapable of voluntary activity, rush outside before one has had time to call them and install themselves normally in the twinkling of an eye. If the ambulance cannot come as far as the first aid station, it suffices for the corporal of the litter squads to ask the medical officer what patients should be carried on a litter; they all immediately answer that they can walk; one gets there faster by walking, at the same time better concealing himself than on a litter.

Of the three principal conditions described in the book—contusion, concussion, and emotional disorder—*the last is by far the most commonly seen* in the first aid station; contusion comes next; not more than four or five cases of true concussion are seen for 100 of emotional disorder.

At the field hospital, and from there on, the syndromes often become less pure. The case of concussion or contusion, on recovery of consciousness, cannot but become more or less emotionally affected by the thought of the great danger which he had escaped and of others to which he may yet be exposed. On the other hand, the emotional patient, finding himself henceforth secure, no longer has his physical and mental activity given over to self-preservation; he is often but a mere case of marked fatigue and, as such, by his depression and inhibition, resembles the case of concussion.

Careful investigation still reveals, however, unmistakable contrasts. As the cases of concussion recover from their physical asthenia, with its characteristic mydriasis and slow pulse, and from the mental dulness, they begin to complain of headache and attacks of dizziness in which, for the moment, everything becomes black and silent. The most frequent termination is complete recovery; all confusion of memory soon disappears; but one recollection is forever impossible—*that of the accident itself* and of a period of greater or lesser duration following it.

The emotional patient arrives at the field hospital bewildered, tired, seemingly inert; if spoken to, will not answer. If one disturbs his somnolence by shaking him or shouting in his ear, he moans, stirs, looks up with a terrified expression, eyes widely open, as if possessed by great anxiety or some hor-

rible vision. Later, on becoming more accessible, when questioned about the accident, the almost invariable response is, "I remember nothing"; he will say, however, that he suffered a "concussion," that a shell dropped close by and exploded. He has, in fact, but one recollection which has survived in his memory, *that of the accident itself*. Yet, with this as a starting point, persistent and tactful questioning gradually elicits details of place, time, occurrences preceding and following the accident, until it becomes clear that the patient had at no time lost consciousness. As Léri puts it, "*Ce grand amnésique n'a pas d'amnésie du tout!*"

Only a minority of cases of concussion or emotional disorder reach the base hospitals—a fact which has often been lost sight of, thereby causing much misapprehension and confusion. By the same nomenclature medical officers of the zones of the advance, communications, and supplies have been alluding to different categories of patients. Léri's descriptions of cases in base hospitals ring truer than the descriptions given by observers who have not been put on their guard by such experiences as he has had at the front and in field hospitals. Of special interest is his attitude in relation to hysteria, to which he devotes a brief chapter.

Many writers have shown a tendency to confound emotional with hysterical disorders. But according to Léri it is a mistake to think that hysterical manifestations are an integral and necessary part of the emotional syndrome. They can appear independently of all emotion; and the emotional syndrome has nothing in common with hysteria. A remarkable fact is that hysterical manifestations never appear except when the patient is in a place of security: in a trench, a dugout, in a first aid station. Moreover, they disappear, as by magic, either when security is diminished, as by the dugout being shelled, or when the ambulance is in sight for the evacuation of the wounded. Often they appear during the period of artillery action in preparation for an attack; but never has an hysterical convulsion or paralysis been seen in the open on the battle-field, under exposure to a barrage—"a fact which seems to us of major interest for the understanding of the pathogenesis of hysterical disorders."

Speaking in particular of refractory hysterical phenomena, Léri says, "In all cases they originate not in emotion, but in reflection, when emotion no longer exists; they originate in the idea of retirement on pension with its double benefit of further removal from danger and pecuniary indemnity."

The material so vividly brought to light by the war has its analogies in peacetime neuropsychiatric experiences. The lessons learned in the war so well presented by Léri should be of permanent value.

Archives of Neurology and Psychiatry

Vol. I

MARCH, 1918

No. 3

ON THE INTRAVENOUS, NOT THE INTRASPINAL, USE OF ARSPHENAMIN IN SYPHILIS OF THE NERVOUS SYSTEM *

B. SACHS, M.D.

NEW YORK

At this critical period of our national life it seems especially important to consider carefully the various methods of treatment of a disease that maims so often and so rarely kills. Those of us who during several decades have had unusual opportunities of studying syphilis of the nervous system realize a great responsibility in the matter of placing before the entire medical profession correct views regarding the various methods of treatment that have been proposed. A year ago I felt impelled to expound what I believed to be "The Truth about Intraspinal Injections in Syphilis of the Nervous System."¹ It is very evident that to some "The Truth" was not altogether palatable. I am more firmly convinced than ever of the correctness of my views, and in a forthcoming publication by Drs. Strauss and Kaliski² a careful critical study of over 400 cases from my service at Mount Sinai Hospital will be given.

Let me state briefly why we pinned our faith to the intravenous use of salvarsan, neo-salvarsan or arspenamin, and why we are ready to reject the more dangerous intraspinal method of treatment.

OF GENERAL INTEREST TO ALL PHYSICIANS

This entire subject concerns not only the neurologists and the dermatologists; it concerns even to a greater degree the general medical practitioner. Among dermatologists, Dr. Fordyce has seen fit to reply to my article of last year. I am most anxious to avoid all personal controversy; the subject is far more important than the personages involved and it would be a grievous error to allow this con-

*From the Neurological Service at Mount Sinai Hospital, New York.

*Read at the meeting of the Association of American Physicians, May, 1918.

1. Sachs, Bernard: The Truth about Intraspinal Injections in Syphilis of the Nervous System, J. A. M. A. 69:681 (Sept. 1) 1917.

2. Kaliski, D. J., and Strauss, Israel: On Syphilis of the Nervous System, Am. J. Syphilis 2:609 (October) 1918.

troversy to descend to the plane of charges and recriminations. Dr. Fordyce³ writes:

If the statements contained in that (my) article are accepted by the medical profession as a final and correct judgment of this new therapeutic procedure (meaning intraspinal injections) an enormous amount of harm will result in that numerous victims of syphilis of the nervous system will be deprived of their only chance to regain health and economic efficiency.

Far from depriving them of their only chance for recovery, I believe that by advocating the intravenous treatment no lives will be lost, no unnecessary paralyses will result from treatment, and far less harm will be done by the innumerable number of medical men who will be called on to treat syphilis of the nervous system than if the intraspinal method were to be generally adopted and heralded as the only efficient method in the treatment of syphilis of the nervous system. The intravenous method, which hundreds of physicians have already learned to administer skillfully will, if energetically pursued, bring about results comparable with those obtained in the treatment of early specific lesions involving other organs. If there is the slightest suspicion that syphilis has invaded the nervous system, let physicians and surgeons give the intravenous treatment and give it to the extent that we have found it entirely safe to give.

VALUE OF SEROLOGIC EXAMINATIONS

Again, Dr. Fordyce implies that there was in my article an attempt to discredit the value of serologic examinations of the spinal fluid as a diagnostic measure and guide to treatment. Such an accusation is entirely unfounded. In my hospital service, all laboratory tests are utilized to the fullest extent possible. My point of view is and has been simply this: Serologic examinations and all the biologic tests are of the greatest possible value as corroborative evidence. I am not willing, however, to allow that clinical evidence is to be entirely superseded or disregarded. So many of the physicians engaged in these researches seem to forget that negative findings, serologically and biologically, do not disprove the presence of syphilis as a causative factor of disease. Wassermann himself in his earliest articles and in all others that have come to my notice, has never departed from this original statement of his.

In our own experience we have again and again, on clinical evidence, and in the absence of positive findings, given intravenous treatment when our own experience has taught us that certain groups of symptoms could only be explained on the assumption of syphilis and

3. Fordyce, J. A.: "Truth about Intraspinal Injections in Treatment of Spinal Syphilis;" *A Reply*, J. A. M. A. **69**:1482 (Nov. 3) 1917.

in no other way. Moreover, I must adhere to the views previously expressed, that there is no actual correspondence between the serologic findings in certain cases of syphilis of the nervous system and the progress of the underlying morbid process. In general paresis we have, possibly as a result of energetic treatment, seen the most marked remissions without any tangible change in the serologic findings. The same is true of tabes and is invariably true of the spastic group of syphilitic disease of the spinal cord. On the other hand, we have entire lists of cases in which the serologic findings show remarkable changes after intravenous injections, after repeated lumbar punctures, without corresponding improvement or deterioration in the clinical symptoms. It is only in the group of the more distinctly specific meningeal disorders and meningo-encephalitic disorders and in some of the vascular group that the serologic findings and the clinical symptoms seem to progress or to deteriorate *pari passu*.

AUTHOR'S OBSERVATIONS

Taking up this subject somewhat more in detail, my associates and myself have endeavored to discover why the intraspinal treatment did not yield the results expected of it and why intravenous treatment in reality accomplished much more than we had a right to anticipate. Although my friend, Dr. Fordyce, waives aside all attempts at theory by assuring us that his patients have been cured and relieved by intraspinal treatment when intravenous treatment had failed, and that they would smile at the thought that successful treatment was theoretically impossible, I believe it not amiss to state once more a few fundamental facts regarding the limitations of the intraspinal treatment of syphilis of the nervous system. I grant that in view of the excellent results obtained in the acute infectious disorders of the central nervous system and recorded by Flexner and his associates, the thought was entirely natural that similar results should be obtained in syphilitic disease. But there is a vast difference between the acute infectious disorders and the more chronic syphilitic disease dependent on the difference in the manner of invasion in the toxic products formed and in the final habitat of the respective micro-organisms.

In general paresis and in tabes the chief lesions are within the substance of the brain or of the cord far removed from actual contact with the cerebrospinal fluid. It is for that reason almost impossible to bring the spirocheticidal remedy into immediate contact with the foci of disease unless these remedies can be introduced through the blood streams. It is only in the earliest stages of tabes dorsalis that the disease, as we have long since known, involves the meninges and the spinal ganglia; later on it sets up marked degenerative changes in

the spinal tissue, and these secondary changes are entirely beyond the reach of the cerebrospinal fluid and its contents. In the remaining meningo-encephalitic and meningo-myelitic processes of specific origin, more or less exudative in character, we would suppose that spirocheticidal substances introduced in the cerebrospinal fluid might have an active therapeutic effect if such substances could course freely in the cerebrospinal fluid and if it could be shown that they were retained in this fluid for any satisfactory period of time. Let me refer here once more to the fact that four years ago, with the assistance of Professor Benedict, we succeeded in showing that salvarsan introduced in the usual quantities into the blood current appeared in the cerebrospinal fluid in appreciable quantities. In this way we refuted the doctrine of the impermeability of the choroid plexus and that salvarsan introduced intravenously could not be expected to exert any influence over the cerebral and spinal tissues. The question, therefore, narrowed itself practically to this: Whether or not as much spirocheticidal substances — for example, arsphenamin — reached the cerebrospinal canal in intravenous treatment, as it was safe to introduce directly into the cerebrospinal fluid by lumbar puncture.

CIRCULATION OF THE CEREBROSPINAL FLUID

I appreciate the ingenious methods which have been elaborated by Ravaut, by Swift and Ellis, and by Ogilvie,* but further studies on the functions and the behavior of the cerebrospinal fluid seemed to have made these methods more or less superfluous. It will not do to disregard the studies of Weed, a pupil of Cushing, who pointed out that the pressure in the cerebral capillaries is considerably higher than the cerebrospinal tension, and that it is "far more likely that fluid leaves the cerebral capillaries and circulates in the capillary and perineuronal spaces yielding nourishment and receiving waste products, and finally leaving the tissues by the pericapillary and perivascular spaces to the subarachnoid cavities over the surface whence absorption into the venous sinuses takes place." The natural inference of these various studies is that a metallic substance like arsphenamin introduced into the spinal canal is rapidly absorbed into the venous system, and if this be true, why not utilize the venous system at once for the conveyance of these metallic substances rather than the roundabout route via the cerebrospinal fluid. It has also been shown that the cerebrospinal fluid circulates imperfectly and that there is very little absorption of this fluid by the cortical or spinal cells.

* Full references to the literature will be found in the abstract by Kaliski and Strauss.

However attractive the intraspinal medication has appeared to be, it is essentially useless and theoretically unsound. British authors, among them Halliburton,⁴ have abandoned the use of arsphenamin in locomotor ataxia and similar late syphilitic affections via the cerebrospinal fluid because they claim it is fatal not only to the syphilitic organism but also to the patient. There is some satisfaction, also, in noting that Major Swift⁵ in an article written abroad now concedes that he never contended that intraspinal treatment alone was the best or the ideal treatment of syphilis of the nervous system, and I am firmly convinced that men like Swift, who surely appreciate physiologic evidence, will grant that thus far the argument is against intraspinal and in favor of intravenous treatment.

ANOTHER REASON FOR ADOPTING THE INTRAVENOUS METHOD

There is still another reason why we have been practically compelled to adopt the intravenous method exclusively in the treatment of syphilitic disease of the central nervous system. Dreyfuss was, perhaps, the first to insist on the frequent repetition and the large doses of salvarsan to be used in these disorders. What his present-day views are we have no means of knowing. Starting out with that suggestion, we have in my own service, become more and more convinced of the value of intensive treatment, especially in the earlier and remedial stages of cerebral and spinal syphilitic disease. We have obtained most satisfactory results from intravenous injections administered on alternate days for a period of three to four weeks according to the symptoms presented by the patient, and then allowing a period of complete rest or giving weekly or semi-weekly injections of salicylate of mercury for a period of four to six weeks and then again starting in with the same course of arsphenamin injections. Some of our patients have received as many as forty or fifty intravenous injections within a period of a year or eighteen months. There may be a few men who could with impunity give the same number of intraspinal injections, but the patient will certainly be none the better for them and even the most skillful of the intraspinal injectionists have had disagreeable experiences to record. Personally, I regard the lumbar puncture as a more or less innocuous procedure provided fluid only is withdrawn, but I have too much respect for the cerebrospinal content to sanction innumerable injections of toxic substances into the canal.

4. Halliburton, W. D.: *The Possible Functions of the Cerebrospinal Fluid*, Brain, Lond. **39**:213, 1916.

5. Swift, H. A.: *Intraspinal Treatment of Syphilis of the Nervous System*, J. A. M. A. **59**: 2092 (December 22) 1918.

DEFINITE RESULTS USUALLY OBTAINED

The medical profession are entitled to know what the actual results are from the use of intravenous medication. Let me summarize my beliefs by stating first that no other specific medication has ever been as satisfactory as has been the intravenous use of arsphenamin. Wherever there is good reason to suspect that the symptoms of nervous disease are due to the specific poison, the antisyphilitic medication should be begun as early as possible and persisted in as long as possible. The very best results will, no doubt, be obtained in those cases in which the anatomic pathologic lesion is relatively slight and young. In the cases of intense headaches, probably meningeal, in some of the earliest forms of specific optic neuritis, in the large number of cases of cerebrospinal syphilis with actual nerve palsies with moderate paralytic symptoms, with incomplete vesical disturbance; in the victims of vascular disease, in arteritis luetica, and above all, in a rather important group of syphilitic epilepsies, intensive intravenous treatment leads not infrequently to a cure and very often to a marked improvement in all the symptoms. But in this group of cases it is easy for us to realize that the morbid process is largely confined to the meninges and to the surface of the cortical or spinal tissue, but the spirochete can no doubt be reached through vascular channels.

A group of purely spastic palsies with very slight sensory changes, with little or no vesical disturbance, with much more rigidity than paralysis, the group which Erb so well described and which is long since recognized as a purely degenerative group, yields least to intravenous or to any other forms of antisyphilitic medication. The question of the effective treatment is most in doubt when we come to consider the results in locomotor ataxia. And here you will pardon me for saying that only those who have had a vast experience in the observation of tabes are able to speak with any sort of authority.* The tabetic pains, the crises, the bladder symptoms, and the sexual impotence, which Fordyce especially advances in his effort to prove that he is curing his patients of tabes by the intraspinal method — all these conditions may be relieved by antisyphilitic medication as we have known them to be relieved by prolonged periods of rest, by hydrotherapeutic procedures, by mercurial injections, by almost any other method of treatment that has from time to time been advocated for the treatment of tabes dorsalis.

SUPERIORITY OF INTRAVENOUS MEDICATION

My own impression based on the large number of cases that we have had under treatment, is that the early and persistent use of

*It might be well to remind some recent writers that ripe judgment in matters neurological does not come by intuition; it has to be acquired.

arsphenamin intravenously administered, makes the entire course of the disease far less progressive than it was formerly wont to be. It is no exaggeration to state that in innumerable cases we appeared to check the progress of the disease. It has been a special source of chagrin to me, therefore, to note the rapid deterioration of symptoms in some of the cases of locomotor ataxia that have done extremely well on intravenous treatment, and after intraspinal medication administered by others and not by us, have developed paralytic symptoms and absolute impairment of the vesical function when there was no reason whatever to expect these symptoms to be superadded to the many others. Aside from this no one can claim that he has actually brought about a single and definite cure in an undoubted case of *tabes dorsalis*. There are cases of *lues cerebrospinalis* that simulate *tabes* as there are others that simulate general paresis in which there may be a return of the knee-jerk or even a change in the pupillary immobility, particularly in the earlier stages, subsequent to the introduction of arsphenamin into the system; but in a full-fledged case of *tabes dorsalis* no one has ever been able to record the actual disappearance of the classic symptoms of the disease.

Very much the same that we have said regarding *tabes dorsalis* might be said regarding general paresis, except that there is in the case of general paresis the added difficulty of estimating the value of any form of medication because of the natural remissions of the disease. The sober judgment based on sufficient experience might lead the therapeutic enthusiast to claim that the remissions are longer than they used to be, that the disease lasts longer than it did in former years. I would not contradict the truth of such statements. In a disease so grave as general paresis it is my ambition to remain optimistic so long as there is the slightest encouragement. Moreover, there is in the earliest period of a very large number of cases of general paresis a reasonable doubt as to the actual disease and we speak of these cases as being doubtful as to whether they are genuine general paresis or whether they are pseudo-paresis which nine times out of ten means nothing else than that in some instances the syphilitic disease may remain restricted to the meninges and to the superficial layers of the cortex, whereas in other cases the disease makes further inroads into the cortical tissue and the spirochetes find their ultimate and permanent resting places within the substance of the brain. So long, however, as there is any doubt regarding the actual development of the disease, it is the duty of every one, particularly in the earliest stages of the disease, to give the most intensive form of intravenous treatment and only to desist when the progress of the symptoms has been such that it is certain that the disease will have to run the usual unfavorable course.

PRACTICAL DEDUCTIONS

The chief practical deduction from these experiences is that the most intensive intravenous treatment should be given as soon as possible after the initial specific infection has been established. Without reference especially to the nervous system, let the most intensive treatment be given so as to avoid later complications. From the frequency with which pupillary immobility can be recognized as the only clinical symptom of constitutional syphilis, I am inclined to think that the nervous system is more often involved in constitutional syphilis than it is generally suspected to be.

In view of the fact that we have observed, particularly in youthful and also in senile individuals, the very early development of syphilitic disease of the central nervous system in spite of intensive intravenous medication, it is well to urge as a measure of safety that the intravenous medication of arsphenamin cannot be begun too early if the ravages of the disease are to be minimized. The future of the success of antisypilitic therapy lies in the hope that the profession at large will insist on this form of treatment in every case of syphilitic infection for a number of years after the initial lesion. And so far as the interests of society at large are concerned, there is a crying need, especially in our large cities, for the adequate intravenous treatment of all patients with the initial syphilitic lesions. Such patients should unquestionably be kept under absolute medical control for a number of years. Further hope lies in the ultimate discovery of a substance less toxic than arsphenamin which in even larger quantities could be introduced, and safely introduced, into the circulation.

HISTOLOGIC EVIDENCE OF THE PATH OF INVASION OF THE BRAIN IN GENERAL PARESIS

SAMUEL T. ORTON, M.D.

PHILADELPHIA

A topographic survey of the brain in cases of general paresis shows that, in the majority of cases, the brunt of the attack is borne by the frontal pole and the anterior parts of the convexity, while the occipital pole is relatively free. In 1913, the writer made a comparative histologic study of six areas from each hemisphere of the brains of fifty cases of paresis and found that the areas of most severe involvement, in the majority of cases, were those supplied by branches of the internal carotid artery. In a smaller number of cases the lesions were widespread and of about equal severity. Cases have been recorded with the maximum damage in the occipital region, that is, the area of distribution of the basilar system and with little or no involvement of the anterior portions of the brain. Apparently in the majority of cases the lesions are more or less strictly confined to areas served by the carotid system; in very rare cases, to that supplied by branches of the basilar artery, while in a considerable number both zones are involved.

HISTOPATHOLOGIC APPEARANCES

Paresis is one of the few mental diseases in which the diagnosis can be confirmed by histopathologic examination, and it is by means of this examination only that the diagnosis can be established with sufficient accuracy for careful scientific analysis. The criterion on which such diagnosis rests is not the destruction of the brain parenchyma, but the widespread perivascular accumulations of lymphocytes and plasma cells. The parenchymal changes are often severe, but they are not pathognomonic, and most typical cases of paresis will show areas of advanced vascular lesions with little or no demonstrable damage to the essential nerve tissues, while in very early cases the amount of damage to the brain structures may be very slight in comparison to the degree of perivascular infiltration.

These two points: (1) That the distribution of the lesions follows roughly one or the other or sometimes both of the main cerebral vascular stems, and (2) that the perivascular changes within the brain are at least as widespread as the parenchymal damage and frequently more so, has led to the conclusion that the path of invasion by the spirochetes is along the perivascular lymphatic channels and the meso-

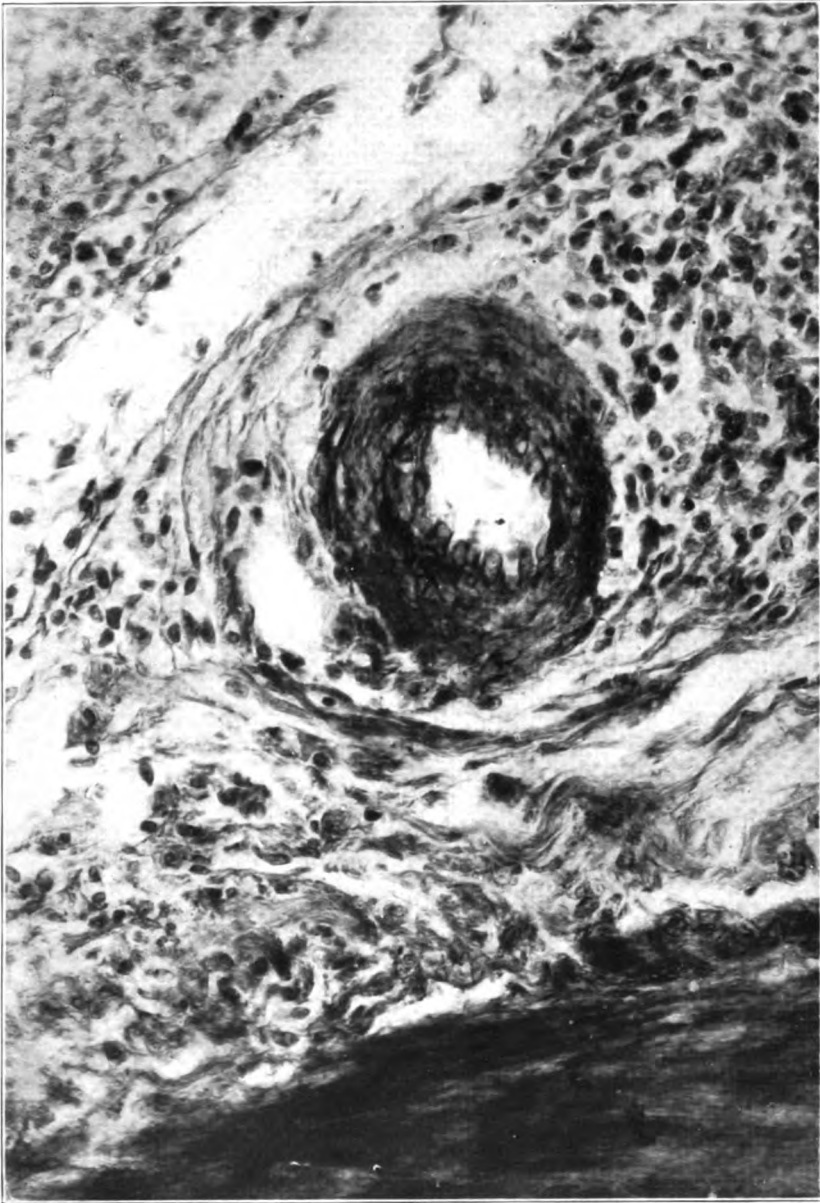
dermal tissues of the perivascular spaces — that is, that general paresis is essentially a perivasculitis with focal invasive spread to the brain parenchyma. This has suggested observations on the larger cranial vessels before they enter the brain mass, and material from nine cases of paresis has been studied with this point in view. The material in some cases was taken from the intracranial but extracerebral portions of the carotid and basilar arteries and in some from the carotids in the neck.

CHARACTER OF THE LESIONS

The lesions encountered naturally fall into two groups: (1) those in which the process is evidently stationary, and (2) those showing evidence of progressive chronic inflammation. The stationary lesions are comparable in every respect to those of healed syphilitic endarteritis. The endothelium is intact, but between it and the elastica is in many places a fairly thick mat of loose-meshed but very well preserved connective tissue which marks the site of earlier endothelial proliferation. The elastica often shows the fibrillation which occurs in syphilitic arteritis, and not infrequently there is a suggestion of the formation of new elastic laminae in the connective tissue scar. These lesions agree with the criteria usually accepted as differentiating syphilitic vascular disease from the other types of arteriosclerosis — that is, splitting of the elastic lamina with separation of the intima and media by a connective tissue scar in which the cell and fiber elements are well preserved and which shows little or no alterations of a degenerative character.

It must be borne in mind that these lesions, while corresponding nicely with those of healed cases of arteritis of established syphilitic origin, do not in themselves offer definite proof of their own etiology. Lesions of this type were found in varying grade in eight cases of the series of nine, and with the known syphilitic infection of all paretics I think it fair to conclude that these patients had suffered with varying degrees of syphilitic arteritis of the cranial vessels during the earlier stages of the syphilitic infection.

The active chronic inflammatory lesions consist in a lymphocyte and plasma cell exudate in the perivascular connective tissue sheath — the adventitia — which is quite comparable with that of the vessels within the brain substance, although the plasma cells are a little less numerous and apparently do not tend to mass together into the mosaics seen around many smaller arterioles in the cortex. Such exudates were observed in eight of the nine cases. In one case, in addition to this cellular infiltration, one very small vessel traveling in the adventitia of the carotid in the neck showed the reduplicated succulent swollen endothelial cells which are found in the acute stages of syphilitic endarteritis as shown in the accompanying illustration.



The heavy dark mass at the bottom of the illustration is the wall of the carotid artery. The small vessel in the middle shows swollen and reduplicated endothelium, and the surrounding connective tissues are infiltrated with lymphoid and plasma cells.

FREQUENCY OF OCCURRENCE

Syphilitic aortitis is known to be common in paretics. And the lesions here are quite comparable in their type to those of the cranial vessels though modified somewhat by the different anatomic conditions. The presence of perivascular lesions in the cranial vessels in their extracerebral course supports the hypothesis of the invasion of the brain by way of the periarterial lymph spaces, and our *envisagement* of the disease-process as a whole would then be that of a persistent vascular infection with a very even balance between the invasive power of the parasite and the resistance of the host lasting over a number of years, which constitute the incubation period of paresis, with ultimate invasive spread in multiple small foci to the brain parenchyma.

The even balance between attack and defense is an essential in determining the long latent period (from six to twenty years), and is supported by the claim of Fournier and the statistical work of Pilez and Mattauschek that paresis is much more apt to occur in cases of *mild* infection. That the final invasion of the brain takes place in multiple foci is apparent from the clinical course of the disease with its many variations, fugacious paralyses and aphasias and frequent improvement or even complete remissions, and this is well supported by the occurrence of nests or clusters of spirochetes in the brain tissues. There is little difficulty in demonstrating the organism either by the dark-field microscope or in stained specimens if one of these active colonies be encountered, but one may often search over large areas of the brain even in advanced cases without finding such a focus. Marinesco has pointed out that when an apoplectiform attack has accompanied death, thus indicating an exact area for examination, the organism can be demonstrated with great constancy.

Granting the focal character of the lesion it is obvious that the clinical picture will depend on at least two factors: (1) the locus, and (2) the irritative or destructive nature of the invasion. The manic forms of many early cases — hallucinosis and convulsions — suggest the irritative or discharging lesion, while permanent paralyses, aphasias and the progress of dementia are the results of a destructive process.

SUGGESTIONS AS TO METHOD OF TREATMENT

The consideration of paresis as essentially a vascular disease might at first sight be considered as an indication for the intravenous method of arsphenamin therapy as contrasted to the intraspinal and intracerebral, and while the writer still considers this the method of choice it must be remembered that the perivascular spaces are separated from the blood stream by the same very efficient filter — the cerebral

vascular endothelium—as are the brain structures themselves. If, however, we accept the hypothesis that paresis is the terminal stage of a latent or very slowly progressive cerebral arteritis comparable to the cavitation stage in tuberculosis, prophylactic treatment in the form of “follow-up” treatment of syphilitics and intensive treatment of those cases which are occasionally encountered of so-called “laboratory paresis” without psychosis offers much greater promise. This, of course, falls for the most part without the province of the neurologist and psychiatrist and in the hands of the dispensary worker and the general practitioner, but the emphasis on the need of consistent therapy must come from the specialist.

ON THE ASSOCIATED INCIDENCE OF SYPHILIS OF THE CENTRAL NERVOUS SYSTEM AND CARDIO- VASCULAR SYPHILIS *

E. D. FRIEDMAN, M.D.

Instructor in Medicine, University and Bellevue Hospital Medical College;
Adjunct Attending Physician, Third Division, Bellevue Hospital;
Contract Surgeon, U. S. Army

NEW YORK

That syphilis plays an important rôle in the causation of aortic aneurysm and aortitis had been long suspected. Weil thought that every case of fibrous aortitis was due to syphilis. Groen studied 306 cases of visceral syphilis and found vascular changes in 76 per cent. of the men and 49 per cent. of the women. Schultze holds syphilis to be the cause of aortitis in practically all cases. Hampeln says, "A definitely diagnosed, circumscribed aneurysm permits the assumption of luetic infection, eight to twenty years previously." Etienne believed 70 per cent. of all aneurysms to be syphilitic in origin; Gerhardt put the percentage at 53, and A. Frankel at 55. The pathologic work of Doehle, Heller and his pupils, Stadler, Chiari, Benda, Marchand and Eich in Germany; of Mitchell Bruce in England, and the clinical studies of Huchard and Dieulafoy in France, have emphasized the syphilitic origin of aortitis and aneurysm. In this country, Cummer and Dexter, Epstein, Held, Longcope, Symmers, Wallace and McCaskey have made contributions to this subject.

That tabes is of syphilitic origin was emphasized by Fournier and Erb. The latter asserted that 88 out of 100 tabetics were syphilitic. Berger thought 20 per cent. of tabetics were syphilitic. Westphal put the percentage at 33, Remak at 23, Rumpf at 66. Eisenlohr at 52.5, Bernhardt at 60, Fournier at 93, Dejerine at 90, Strümpell at 90. Quincke and Moebius assert dogmatically that every tabes is the result of syphilis. Barker (in *Monographic Medicine*) says: Tabes is due to syphilis while Dana puts syphilis as the important and essential cause. Starr maintains that 90 per cent. of the cases are due to syphilis; he calls it, however, parasyphilis because it follows syphilis and is not cured by antisymphilitic therapy.¹

* Read to the Section in Medicine, New York Academy of Medicine, Jan. 15, 1918.

1. This, however, does not seem a valid argument to us. *Hepar lobatum* is also incurable, yet no one speaks here of paralues. We cannot cure scars or sclerosis, especially in the nervous system.

Formerly Jews were relatively free from tabes. Now with increasing exposure to infection due to the breaking down of the religious barrier, tabes is quite common among them; this illustrates the etiologic importance of syphilis. The inoculation of rabbits with syphilis by means of cerebrospinal fluid taken from cases of early central nervous syphilis has been accomplished by Uhlenhuth and Mulzer, Hoffman, Nichols and Hough, Kleiner, Volk, Arzt, Kerl and Mattauschek, Marinesco and Minea, Frühwald and Zaloziecki, Reasoner, Dohi and Tanake, Graves, Wile and others.

With the demonstration by Noguchi and Moore of the spirochetes in the brain of general paretics and, though more rarely, in tabes, the confirmation of these findings by Marinesco, Marie and Levaditi and the demonstration of specific changes in the cerebrospinal fluid in syphilitic infections of the central nervous system, we may say with Erb that so-called *meta* or *para* syphilis is syphilis, and only the variations in maximum localization of the process produce the clinical pictures we know.² That the heart is frequently involved early has been shown by Brooks, and the early involvement of the meninges is shown in the characteristic changes in the spinal fluid present in the second stage of syphilis. This was first shown by Dreyfus and later confirmed by many other observers.

FREQUENT ASSOCIATION OF SYPHILIS OF THE CARDIOVASCULAR AND NERVOUS SYSTEMS

The frequency of the association of cardiovascular and central nervous syphilis was not noticed until Berger and Rosenbach, in 1879, called attention to the coincidence of tabes and aortic regurgitation. They reported seven cases, but did not emphasize the relationship between the two conditions. Charcot, too, had noted this coincidence, and Vulpian had spoken of anginal attacks occurring during the course of tabes without explaining the association. They both agreed that the cardiovascular lesions came on late in tabes—a fact to which Stadler also called attention.

Letulle observed that tabes frequently was associated with cardiac lesions, especially aortic regurgitation. His first case came to post-mortem. There was degeneration of the posterior columns and atheroma of the aorta and the cerebral vessels. The aortic valve was thickened and retracted. The second case showed a double aortic lesion and tabes. He thought chronic arteritis was the underlying cause of both conditions, and significantly concludes, "If a cardiac lesion is present in tabes, it is generally aortic regurgitation. Both

2. Warthin has emphasized the essential uniformity of the pathologic changes in all forms of syphilis.

are due to a common cause, namely, chronic arteritis." Colgahoun reported two cases of tabes with aortic regurgitation, but thought the tabetic pain caused the aortic regurgitation, and that possibly the vagus played a rôle or that circulatory changes in the cord might contribute to the tabetic condition.

Leyden wrote of anginal attacks and cardiac asthma in tabes and assumed trophic changes in the valves as the cause of aortic regurgitation. In one case of what must have been conjugal syphilis he explained the occurrence of an aneurysm in the wife of a tabetic as having been due to cardiac strain as a result of the wife's nursing her tabetic husband. Balacakis found three cases of aortic regurgitation among fifty-five tabetics, but was not impressed by their association, ascribing the valvular lesions to rheumatism. In reporting two cases Grasset thought tabes was the primary condition and the cardiac lesion due to painful crises. He also thought that the cardiac lesion had long been latent. In the first edition of his text book (1884). Strümpell spoke of the common origin of the two conditions. In a case of Oppenheim's the necropsy revealed tabes, atheroma of the aorta and of the cerebral vessels, and an incompetent aortic valve.

Fournier, Grasset and Letulle thought that on the whole aortic disease was rare in tabes while Charcot, Vulpian and Raymond speak of the relative frequency of the association. With more recent pathologic studies, the view, ascribing both tabes and aortic disease to syphilis, gained ground, and this hypothesis easily explains their coincidence.

Ruge and Huttner found nine cases of aortic regurgitation among 138 tabetics. They conclude: "Those tabetics who develop cardiac disease have it chiefly at the aortic valve. The coincidence of tabes and aortic disease is due to a common cause—lues." Nordmann reviewed the reported cases up to 1894, and found 134 cardiacs among tabetics, 65 being cases of aortic disease. The other 69 involved other orifices alone. He also reported 8 cases of aortitis among 100 tabetics. Schuster found three cases of aortitis among 22 tabetics, and Marie one cardiac to four or five tabetics, most of them with disease of the aortic valve. Hertz examined 98 tabetics and found six cases of aortic regurgitation, two of aneurysm and 16 cases of dilated arch with carotid heaving, elevation of the right subclavian artery, pulsation in episternal notch and inequality of radial pulses. In 50 per cent. of his cases of cardiac disease, among tabetics the aorta was involved. In another series he found 48 cases of aortic regurgitation among 76 tabetics with cardiac disease.

Bouveret heads one of his contributions to this subject as follows: "Syphilis-ataxie cardiopathie"—a suggestive title. Enslin reported

seven cases of tabes with aortic insufficiency, and Friedrich Müller a case of aortitis and tabes. There was a to and fro aortic murmur, enlargement of the heart, and at the same time, miotic fixed pupils and ataxia. F. Lesser collected eighteen cases of aortic aneurysm among ninety-six cases of tabes which came to necropsy, and Barthelemy (quoted by Guilly) reported seven cases of tabes with aortic disease.

Guilly reasons as follows: Syphilis is frequent in tabes; it also causes aortitis; hence aortitis and tabes probably have the same etiology, namely, syphilis. He reports thirty-three living patients who have general paresis with ten cases of aortic disease among them, and 200 cases of general paresis which came to necropsy. Forty-one of the latter showed evidence of aortic disease, aortitis, changes at the valve, atheroma. These taken together make a total of fifty-one cases of aortitis among 233 cases of general paresis, that is, one case of aortitis, aortic regurgitation or aneurysm to five cases of general paresis. Aortic regurgitation was the most common lesion during life, and when nothing was found clinically the changes were present at necropsy. As a result of his own studies and a review of the literature, he concludes that aortitis is frequent in the course of tabes. Frequently there is cardiosclerosis with irregularity of rhythm. In general paresis, aortitis is present in about 20 per cent. of the cases, chiefly in the young (under 45), and probably due to syphilis.

Rogge and Mueller think that the frequency of this association and its clinical significance are not sufficiently appreciated. Usually one of the two conditions dominates the clinical picture; the symptoms and signs of the latent condition must be carefully elicited. Tabes in a case of aortitis may be very mild. Guilly and Strümpell also note this point. Our own observations confirm the statement. Strümpell speaks of rudimentary tabes. Rogge and Mueller found eight cases of cardiovascular disease among twenty-two tabetics. This percentage is rather high. The average is about from 10 to 20 per cent. In twenty-four selected cases showing this association, the most frequent lesion was aortic regurgitation or aortic regurgitation and obstruction. In 15 per cent. of the twenty-four there were tabes and aortic disease, and in nine there were tabes and aneurysm. Most showed evidences of myocardial degeneration and premature atherosclerosis. In only 58.3 per cent. were there definite cardiac complaints. The cases of sudden death reported in tabes are probably due to sudden dilatation from myocardial degeneration, coronary thrombosis or rupture of an aneurysm. In nine of these cases there was definite evidence of syphilis and in ten others it was probable. In only two was there a history of polyarthritis. "Rheumatism" in these cases usually means

tabetic pain. Seven of the twenty-four patients were women. The average age was about 40. (Bittorf found the average age in non-syphilitic aortic sclerosis to be 55.) The cardiovascular symptoms come later than the nervous phenomena, according to Rogge and Mueller, about four and one-half years later. A lesion in the cord will give symptoms much earlier than one in the aorta. More recently L. Braun reported 103 cases of general paresis with twenty-three certain and five probable cases of aortitis among them. Nobel reported the case of a boy showing aortic regurgitation, with unequal, fixed pupils, exaggerated knee-jerks and ankle-jerks, with dementia, speech disturbance and a positive Wasserman reaction. E. L. Hunt, in the course of an article entitled "Complications of Tabes," mentions the occasional occurrence of aneurysm or aortitis without, however, citing any cases. Dana in the latest edition of his textbook speaks of cardiac crises in tabes, that is to say, dyspnea and angina-like attacks. Starr found nine cases of aortic murmur in 126 cases of tabes, and Levinson has mentioned this association.

SYMPTOMS USUALLY MILD

Tabes in a case of vascular syphilis usually is mild. The pupils may be miotic, rigid, unequal and irregular. The Achilles jerk, alone, may be lost. Hypotonus may be present even in cases with exaggerated knee-jerks and as a result, tabetic flat-foot. There may be girdle sensation zones of hypoesthesia-radicular in type, lancinating pains, gastric crises. Frequently there is retention of urine—another evidence of sacral tabes. Patients will say with a great deal of pride that they can hold their water all day. The Abadie symptom—loss of sensitiveness of the biceps tendon or tendo Achilles to pinching—is a common early sign. There may be ulnar hypoesthesia. Goodkind described hypoesthesia of the anus and urethra.

On the other hand, cardiac symptoms in a case of tabes or general paresis may be scanty. The absence of history of rheumatic fever or other infectious disease in case of aortic regurgitation, the localization of the murmur, chiefly in second right interspace,³ and the occurrence of aneurysm in the young are suggestive evidence of cardiovascular syphilis and evidence of this disease should be looked for.

In radiographic examination, aneurysmal bulging may be seen in the first oblique diameter, encroaching on the so-called retrocardiac

3. The murmur of syphilitic aortic insufficiency frequently is loudest in the second right space and not at Erb's point where endocarditic aortic insufficiency usually is best heard. This is said to be due to changes in the wall of the aorta which cause better transmission to the superficially situated ascending aorta.

space. Every case of tabes should be examined radiologically and if possible electro-cardiographically to determine changes in the cardiac musculature to which Brooks in this country first called attention. Usually, as outlined above, one of the two conditions dominates the clinical picture. This may be due to variations in tissue or strain affinities (Reasoner). The spirochetes seem to exert their maximum effect in one system without completely neglecting the other. So patients with myocardial changes occurring early in life—with dyspnea, anginal attacks, palpitation, cough, slight edemas—should be examined for signs of tabes. Careful neurologic examination may illuminate obscure visceral lesions. For example, a fixed pupil may clear up the syphilitic origin of an obscure liver affection, and a lost Achilles jerk may indicate that a stomach syndrome is a gastric crisis. We are fortunate in being able to corroborate our diagnosis by serologic tests, but we must express our admiration for the host of clinicians who could draw accurate conclusions without laboratory aids.

AUTHOR'S OBSERVATIONS

My own observations were made first on fifty cases of tabes at the Central Neurological Hospital, New York City. Those with definite rheumatic history were excluded. There were seven cases of cardiovascular syphilis among them. One other case showed at the same time an uncomplicated aortic insufficiency and left-sided cerebral thrombosis with motor and sensory paralysis, astereognosis, motor aphasia, and mimic facial palsy. Concerning this case we could not say definitely whether the cerebral lesion was due to embolism from the diseased aortic valve or to autochthonous thrombosis. The absence of evidence of embolism anywhere else and the stationary character of the valvular process would seem to point to the latter.

ILLUSTRATIVE CASES

CASE 1.—Man, aged 51, contracted syphilis eighteen years ago. Circulatory: Aortic regurgitation; aortitis; Corrigan pulse. Nervous: Pupils, unequal—left smaller and sluggish to light; knee jerks only with reinforcement; ankle-jerks, absent; Abadie's sign, positive; ulnar hypesthesia; cochlear and vestibular function lost on the right; undue retention of urine; impotence. Serologic: Blood Wassermann, ++.

CASE 2.—Man, aged 42, became infected with syphilis twenty years previously. Circulatory: Diastolic murmur at apex; to and fro murmur at Erb's point and second right interspace; Corrigan pulse; manubrium dulness; pulsation in episternal notch. Nervous: Pupils, fixed; hypotonus; knee-jerks and ankle-jerks, absent; Romberg sign, positive; incontinence of urine. Serologic: Blood Wassermann, +++.

CASE 3.—Man, aged 33, was infected with syphilis fourteen years ago. Circulatory: Cardiac asthma; decompensation; no murmurs (even after return of compensation); arrhythmia. Arrhythmia not altered by injection of atropin (myogenic). Nervous: Pupils were unequal, miotic and irregular, sluggish to light; ankle and knee jerks, absent; hypotonus; Romberg sign, present; undue retention of urine; Abadie's sign, positive; vibratory sense, absent. Serologic: Spinal fluid was weakly positive.

CASE 4.—Woman, aged 49, had syphilis. She was well up to three years ago when she had pain in the left leg and had to watch her feet. Later there was pain in her right leg with numbness and tingling and she was unsteady on her legs. Circulatory: Systolic murmur in aortic area transmitted upward into vessels of the neck; dulness over manubrium; pulsation in episternal notch. The roentgen ray revealed a dilated aorta. Nervous: Pupils, equal, Argyll Robertson; pallor of left disk; deep muscle and joint movement sense, impaired in all extremities; vibration sense lost; ataxia; knee and ankle jerks, absent. Serologic: Wassermann on blood and spinal fluid was negative; fluid showed increase of globulin and 22 lymphocytes to the cubic millimeter.

CASE 5.—Woman, aged 43, with no history. Circulatory: Systolic murmur in aortic area, transmitted upward; dilatation of ascending aorta. Nervous: Pupils, fixed; ankle jerks, absent; bladder symptoms. Serologic: Blood Wassermann, ++.

CASE 6.—Woman, aged 44, had been a prostitute. Circulatory: Systolic murmur in aortic area; loud diastolic at Erb's point and second right interspace; pulsation in episternal notch. Roentgen ray revealed a dilated arch especially at junction of transverse and descending aorta. Nervous: Argyll Robertson pupils; Romberg sign, present; knee-jerks, absent; radicular anesthesias. Serologic: Both Wassermann tests, positive.

CASE 7.—Woman, aged 40, gave no history. Circulatory: Aortic systolic murmur; very loud aortic second sound without elevation of blood pressure. Diffusely dilated arch, especially ascending aorta. Nervous: Argyll Robertson pupils; knee-jerks, absent; Romberg, present; ataxia; bladder symptoms. Serologic: Both Wassermann tests were weakly positive; increased globulin in spinal fluid and 24 cells to the cubic millimeter.

COMMENT

There were two additional cases in this series, but their respective ages were 55 and 57, and they both showed hypertension. Since in these cases dilatation of the arch of the aorta and aortic murmurs may have been the result of simple atherosclerosis without syphilis, we did not include them in our series.

We have recently been able to observe forty cases of syphilis of the central nervous system, admitted to the Third Medical Division of Bellevue Hospital. Among these there were seven cases of cardiovascular disease affecting chiefly the aorta.

CASE 8.—Man, aged 53, had a chancre twenty years previously. Circulatory: Heart displaced downward and to the right; very loud aortic second sound. The roentgen ray revealed an aneurysm of the descending aorta with distortion of cardiac outline. Nervous: Pupils were miotic and fixed; knee and ankle jerks, absent. Serologic: Blood Wassermann, ++.

CASE 9.—Man, aged 42, had a chancre when 26 years old. Circulatory: Systolic murmur in aortic area; metallic ringing aortic second sound. The roentgen ray revealed a diffusely dilated arch. Nervous: Pupils were miotic and fixed; knee and ankle jerks, absent; hypotonus; undue retention of urine; sensory changes; genu recurvatum; marked ataxia. Serologic: Both Wassermann tests, ++.

CASE 10.—Man, aged 46, had a chancre twenty years previously. Circulatory: Myocardial insufficiency with decompensation; dilated arch. Also large nodular liver, after return of compensation (hepar lobatum). Nervous: Pupils were irregular and sluggish; knee and ankle jerks were much diminished. Serologic: Blood Wassermann, ++++.

CASE 11.—Man aged 51, had a chancre thirty years ago. Circulatory: Aneurysm of common carotid artery; metallic aortic second sound; valvular first sound of heart; blood pressure, 140/90; large nodular liver; dyspnea. The roentgen ray revealed a widening of the aorta especially in the descending portion of arch. Nervous: Pupils were small and sluggish to light; ankle jerk, absent; incontinence of urine. Serologic: Blood Wassermann, +++.

CASE 12.—Man, aged 38, had a chancre ten years ago. Circulatory: Apex beat was in the sixth space in the anterior axillary line; double aortic murmur; dulness over manubrium; pulsation in episternal notch; throbbing carotids; Corrigan pulse; systolic tone in vessels; systolic thrill in aortic area. Nervous: Pupils were unequal, both Argyll Robertson; ptosis of upper lid; ankle jerk very much diminished; undue retention of urine. Serologic: Not studied.

CASE 13.—Man, aged 36, denied that he had syphilis. Circulatory: Double aortic murmur; systolic murmur transmitted into vessels of the neck. The roentgen ray revealed a diffuse dilatation of the arch, especially marked in transverse portion (fusiform aneurysm). Nervous: Basilar meningitis involving the fifth, seventh and eighth nerves on the left; knee and ankle jerks were absent. Serologic: Blood Wassermann, ++; spinal fluid, globulin increased, 1,000 cells to the cubic millimeter.

CASE 14.—Man, aged 53, denied syphilitic infection. He had had anginal attacks for two years. Circulatory: Double aortic murmur with visible diffuse pulsation; dulness of upper sternum. The roentgen ray revealed a dilated arch. Nervous: Pupils were irregular, very sluggish to light; hypotonus; knee and ankle jerks were absent. Serologic: Blood Wassermann, ++++.

Finally I have selected several cases from my own records which illustrate this association. Out of a total of thirty-five cases of syphilis of the central nervous system, there were five cases showing coexisting cardiovascular syphilis.

CASES OBSERVED PERSONALLY BY THE AUTHOR *

CASE 15.—Man, aged 44, denied that he had syphilis. He complained of "fainting spells," loss of memory, mental deterioration, that he was clumsy and awkward in his work (that of plumber) for last year. Circulatory: Systolic murmur in the aortic area; blood pressure, 140/100. The roentgen ray revealed a very much dilated aortic arch. Nervous: Pupils were miotic and fixed; weakness of the right lower facial; tongue deviates to right; deep reflexes exaggerated on the right, abdominals diminished; dysarthria; motor aphasia (?); tremor of face and tongue. Serologic: Blood Wassermann, ++.

CASE 16.—Man, aged 57, had syphilis sixteen years previously. Circulatory: To and fro murmur in aortic area; much diminished aortic second sound; right radial showed less pulsation than left; blood pressure, 140/70. The roentgen ray revealed a dilated aorta. Nervous: Pupils were very sluggish, miosis; knee jerks increased; Babinski sign on the right. Mendel-Bechterew and Rossolimo, positive on both sides; abdominalis diminished; tremor in right facial; mental changes; speech defect; vertigo. Serologic: Blood Wassermann, ++++; spinal fluid showed the globulin increased 35 cells to the cubic millimeter; Wassermann reaction, ++.

CASE 17.—Man, aged 50, denied that he had syphilis. He had dyspnea for some time, was impotent and could not pass his urine at will. Circulatory: Dulness over manubrium; embryocardia; loud ringing second aortic; blood pressure, 140/90; pulsation in notch; liver enlarged, edge was hard and sharp, no tenderness. The roentgen ray revealed a typical aneurysm. Nervous: Right pupil was irregular, both fixed; knee and ankle jerks diminished; Abadie's sign, +; definite ulnaris hypesthesia. Serologic: Blood Wassermann, ++++; spinal fluid not examined.

CASE 18.—Man, aged 45, was infected with syphilis twelve years previously. He had a lesion on his neck which refused to heal; bleeding from nose; ulcerating lesions in the throat. He was treated for diphtheria, but with no benefit. He had diffuse abdominal pain with passage of tarry stools. There was a stellate scar on the right tonsil. Circulatory: Blood pressure, 110/70; vessels sclerosed; spleen palpable; probable thrombosis of intestinal vessels. The roentgen ray revealed a hypoplastic heart. Nervous: Pupils were miotic and irregular, sluggish reaction to light; knee and ankle jerks absent; loss of sense of fulness of bladder; hypotonus; gastric crises (?). Serologic: Both Wassermann tests were negative; spinal fluid shows simply increased globulin; luetin test positive.

CASE 19.—Man, aged 49, had a chancre twenty-five years ago. A number of times he could not pass urine at will. Circulatory: Systolic murmur in aortic area; very loud second aortic; blood pressure, 150/90; liver palpable, nodular (hepar lobatum). A roentgenogram revealed a definitely dilated arch. Nervous: Pupils were unequal, fixed; ankle-jerk much diminished; left abdominal reflexes, absent; Rossolimo, positive on left; anal crises; disks grayish. Serologic: Blood Wassermann, ++++.

To my mind the pupillary changes in aneurysm are rarely due to pressure on the cervical sympathetic. They are rather the result of the associated syphilis of the nervous system.

* Several of the cases cited showed the picture of parenchymatitis luetica, a term coined by Brauer to denote simultaneous involvement of all parenchymatous organs; heart, liver, kidney, and nervous system. (Cases 10, 11, 17 and 19.)

FURTHER OBSERVATIONS

Through the courtesy of Dr. Douglas Symmers, I have had access to the postmortem records of the State Hospital for the Insane at Morristown, N. J., for the period of 1907-1915. There were eighty-three patients who had general paresis. Of these, I have selected only those about 45 years old or less who had changes in the aorta indicative of syphilis. There were forty-nine such cases, and among the remaining older cases the lesion in the aorta was aortitis luetica in thirteen, making a total of sixty-two cases with syphilitic aortic disease, that is, 75 per cent.

SUMMARY

Summarizing my own observations, I may say that among 125 cases of syphilis of the central nervous system, there were 19 cases of cardiovascular disease—an incidence of 14 per cent. Of these, 13 showed disease of the aortic valve either alone or in combination with aneurysm or dilatation of the aortic arch. There were two cases of myocardial degeneration with resulting decompensation. Two showed typical aneurysms without demonstrable disease of the aortic valve. In the series was one carotid aneurysm and one patient showed the clinical picture of premature atherosclerosis with probable occlusion of mesenteric vessels.

INTRASPINAL TREATMENT

A word on intraspinal treatment. That the cerebrospinal fluid is poor in antibodies is shown by the necessity of taking larger quantities of it than we do of blood serum for the Wassermann test. We also know the value of serum in cerebrospinal meningitis when the antibodies are introduced from without. Attempts to treat general paresis with nucleic acid and tuberculin injections really resolve themselves in efforts to stimulate the antibody mechanism which we now know is intimately associated with fever. So too, it seems to the writer, it is not so much a question of introducing arsphenamin into the cerebrospinal fluid; it is rather one of introducing antibodies. The value of a preliminary intravenous injection of arsphenamin would consist in the destruction of spirochetes with consequent calling into play of the antibody mechanism of the blood. The injection of the patient's own serum would then furnish the antibodies which seem to get into the cerebrospinal fluid with difficulty. It would be for the immunologist to devise a means of concentrating the antibodies in the blood and then making use of them for therapeutic purposes.

74 East Ninety-First Street.

BIBLIOGRAPHY

- Arzt and Kerl: *Wien. klin. Wchnschr.* **27**:785, 1914.
 Arzt, Kerl and Mattauschek: *Wien. klin. Wchnschr.* **27**:787, 1914.
 Balacakis: *Des lesions aortiques chez les ataxiques*, Paris Thésés, A. Parent, 1883, No. 152.
 Backhaus: *Ziegler's Beitr. z. path. Anat.* **22**:147.
 Barthelemy: Quoted by Guilly.
 Benda: *Verhandl. d. deutsch. path. Gesellsch.* p. 164, 1903.
 Berger and Rosenbach: *Berl. klin. Wchnschr.* **27**:402, 1879.
 Bittorf: *Arch. f. klin. Med.* **81**:96.
 Bouveret: *Lyon Medical*, No. 43, p. 235, 1885.
 Bouchard: *Sur les Troubles viscéraux dans l'ataxie locomotrice progressive*, Paris Thésés, 1875, No. 460.
 Braun, L.: *Mitt. d. Gesellsch. f. inn. Med. u. Kinderh.* **9**: Suppl. 1, 1910.
 Bruce: *Lancet* **2**:69, 1911.
 Chiari: *Verhandl. d. deutsch. path. Gesellsch.* p. 137, 1903.
 Colgahoun: *Tr. Second Intercolonial Medical Congress of Australia*, Melbourne, p. 135, 1889.
 Cummer and Dexter: *J. A. M. A.* **59**:419 (Aug. 10), 1912.
 Dieulafoy: *Clinique Medicale de l'Hotel Dieu* **7**:71, 1896.
 Doehle: *Deutsch. Arch. f. klin. Med.* **55**:190, 1895.
 Dohi and Tanake: Quoted by Wile.
 Eich: *Frankfurter Ztschr. f. Path.* **8**:373, 1911.
 Epstein, J.: *New York M. J.* **101**:847, 1915.
 Enslin: *Inaug. Dissertation*, Berlin, 1898.
 Erb: *Deutsch. Ztschr. f. Nervenhe.* **47-48**:74.
 Frühwald and Zalo: *Berl. klin. Wchnschr.* p. 9, 1916.
 Gaucher and Merle: Quoted by Wile.
 Goldscheider: *Med. Klinik* **8**:471, 1912.
 Grasset: Quoted by Bouveret.
 Graves, W. W.: *J. A. M. A.* **61**:1504 (Oct. 25), 1913.
 Groen: Quoted by Guilly.
 Guilly: *Frequence de la coexistence chez les syphilitiques des aortites avec le tabes et la paralysie generale*, Paris Thésés 1904-1905, No. 57.
 Hampeln: *Berl. klin. Wchnschr.* **44-45-47**: 1894.
 Held, I. W.: *Med. Rec.* **84**:1105, 1913.
 Heller: *München. med. Wchnschr.* p. 50, 1899.
 Hertz: *Les nerfs du coeur chez les tabétiques*, Thésés de Paris 1903.
 Hoffman: *Dermat. Ztschr.* p. 561, 1906.
 Hunt, E. L.: *J. A. M. A.* **59**:1187 (Sept. 28) 1912.
 Huttner, W.: *Ueber das Zusammentreffen von Tabes Dorsalis und Herzklappen Fehlern*, Inaug. Dissertation, Berlin, Ebering, 1897.
 Joubert: *Thésés de Paris*, 1881—Summarized, French literature.
 Letulle: *Gaz. méd. de Par.* **39-40**:504, 1880; *Presse méd.* **4**:605, 1896.
 Levison: *Am. J. Syphilis* **2**:45, No. 1.
 Leyden: *Ztschr. f. klin. Med.* **11**: p. 112; *Deutsch. med. Wchnschr.* **14**:917, 1888.
 Longcope: *Arch. Int. Med.* **11**:14 (Jan.) 1913.
 Marchand: *Verhandl. d. deutsch. path. Gesellsch.*, p. 197, 1903.
 Marie, Levaditi and Bankowski: *Ann. de l'Inst. Pasteur* **27**:576, 1913.
 McCaskey: *New York M. J.* **104**:60, 1916.
 Marinesco and Minea: *Semaine méd.*, p. 357, 1914.

- Müller, Fr.: Volkmann's Samml. klin. Vortr. neue Folge Innere Med., p. 385, 1903-1907.
- Nichols and Hough: J. A. M. A. **60**:108 (Jan. 11) 1913, and **61**:120 (July 12) 1913.
- Nobel: Mitt. d. Gesellsch. f. Inn. Med. u. Kinderh. **2**:259, 1912.
- Noguchi and Moore: J. Exper. Med. **17**:232, 1913.
- Noguchi: J. A. M. A. **61**:85 (July 12) 1913.
- Nordman: Le Coeur de Tabétiques, Thèses de Paris, 1895.
- Oppenheim: Arch. f. Psychiat. **20**:131, 1889.
- Pitzsche: Inaug. Dissertation, Leipzig, March, 1903.
- Reasoner: J. A. M. A. **66**:1917 (June 17) 1916.
- Rogge and Mueller: Deutsch. Arch. f. klin. Med. **89**:514, 1906-1907.
- Ruge and Hüttner: Berl. klin. Wchnschr. **34**:760, 1897.
- Schultze: Quoted by Strumpell.
- Schuster: Deutsch. med. Wchnschr. **29**: 737, 1903.
- Sezar and Paillard: Quoted by Wile.
- Steiner: Neurol. Centralbl. **33**:132, 1914.
- Strumpell: Deutsch. med. Wchnschr. **33**:1931, 1907.
- Symmers and Wallace: J. A. M. A. **66**: 397 (Feb. 5), 1916.
- Uhlenhuth and Mulzer: Centralbl. f. Bakteriöl. **57**: 158, 1913.
- Vulpian: Mal du Syst. Nerveux, 377, 1889.
- Volk: Wien. klin. Wchnschr. **26**:1824, 1913.
- Wile: Am. J. Syphilis, **1**: 84, 1917.

SYSTEMATIC STUDY OF THE PERSONALITY IN ESTIMATING ADAPTABILITY

G. S. AMSDEN, M.D.

BLOOMINGDALE HOSPITAL, WHITE PLAINS, N. Y.

If we were to summarize in the briefest way the advance of recent years in psychiatric teaching, we should be obliged to group what is to be said around a very conscious use of the conception of adaptation or adjustment of the individual to the needs presented within himself and by his environment. Problems involving the instinctive urgency for adjustment, the reaction of the individual in his failure to adjust himself, the alternatives automatically resorted to when for any reason there is resistance to adjustment, the interplay of partial adjustments and of alternatives—fortunate and unfortunate—have formed topics of intensive studies which have furnished the tools of modern psychiatric practice. Gradually these studies have brought into the foreground certain features and have, by detailed exposition, so adequately demonstrated their importance and significance that we are now justified in taking for granted that, wherever these particular features are found, there has been an approaching sequence of details the general nature of which may be assumed and depended on as known factors in figuring out the problems our cases bring to us.

SCOPE OF THE PRESENT ARTICLE

With this general assumption in mind I wish to present in a somewhat organized form observations relating to the personality which probably are individually not unfamiliar. The conception that the personality, as the accumulation of habitual reactions which the individual may under most circumstances be depended on to employ, gauges the adaptability of the individual, is, perhaps, a sort of truistic one. I wish simply to cite and organize the interpretation of those traces in the personality which, under circumstances of mental or nervous disorder, enable us to see more clearly and at the earliest possible moment the adaptive needs and deficiencies of our cases and so to handle them with greater precision.

It is, I assume, unnecessary in discussing the matter of adaptation, as it applies within the region of psychiatric interest, to express the imperative need of not neglecting the weight of toxic or other organic reducing causes which may enter into the etiology of mental disorders. Factors of that type are of the utmost importance. It may, however, only be fair to express the conviction that, for the most part, such

reducing factors tend mainly to reduce and, as a result, those forces which work after an habitual fashion are apparently left free, or in a less hampered way, to follow the course determined by their natural momentum, after the manner of the adage that "there is truth in wine." Whether the personality, as such an habitual force, serves to guide the individual into a psychosis is another question and may be left to a later time to discuss. I am now undertaking to present merely such indications of limitation of adaptability as a study of the personality may reveal.

In a somewhat academic way it can be stated that, with regard to adaptation, we may adapt ourselves with reasonable fulness, we may partially adapt ourselves, we may fail to adapt ourselves and remain inert, or we may more or less completely fail to adapt and, instead of being inert, we may engage in a variety of types of activity the most of which may have the function of substituting for good adaptation, or of serving in some other way as a blind or an excuse which enables us to evade the issue without the raw recognition of it we might otherwise have. It is with reference to some such scheme as this that I wish to arrange and present some illustrative cases, and to point out peculiarities of personality apt to be correlated with miscarriages of adaptation of one sort or another.

The first two cases are examples of personality of relatively well-balanced type.

ILLUSTRATIVE CASES

CASE 1.—Present History.—The first case is that of a minister, aged 26. When he entered the hospital he had an acute psychotic episode characterized by mental clouding, blind restlessness and hallucinations of sight and hearing. He could be aroused rather readily so as to respond fairly clearly for a few moments, only again to drop back into his previous state. His general attitude, nevertheless, was frank and free from restraint. He was much reduced physically. At the time he was regarded as an instance of delirium with exhaustion as a leading factor. This was confirmed by a speedy and complete recovery.

Past History.—His adolescence presented nothing especially striking. He was reared in a rather stiff, rigid family atmosphere. He progressed normally, or somewhat better than the average, in school. He entered college at 18, but after ten weeks left because he was homesick—an episode which unfortunately was not made clear. He then went to the Middle West and entered a high school. He soon became engaged. The next year he entered college. He did well there and supported himself by preaching. After college he taught Latin a year and then entered the theological seminary. He still supported himself by preaching and at the end of his first year in the seminary and six months before his admission to the hospital, he married. He started a strenuous course in the Fall. In November he began to sleep poorly. He received some medicine that helped him so much that he was a little suspicious of it. He did not relax in his work, became more sleepless, and finally after an especially difficult and successful undertaking he broke down in a delirium.

Personality.—There were in the delirium plain enough disclosures 'of repressed instinctive tendencies both before and after his marriage. His conflicts in regard to his wife, which he repressed and which had caused him considerable struggle, stood out plainly in his productions. Yet, if we were to standardize him from his productions and general symptomatic behavior, he would undoubtedly compare favorably with the normal. In his delirium he presented a frankness and transparency incompatible with habitually poor adaptability. His history, furthermore, demonstrates a good adaptability. His interest in religion was apparently not one in reaction to any especially sharp internal conflicts. It was a rather natural outcome of his home environment.

His personality is likewise transparent. Intellectually he is above the average, both in acquisition and in application. In his application he shows a tendency to overactivity—that is, he is talkative, is very industrious and is inclined to work under tension. A motive for this is at once seen in a moderate feeling of insecurity. He is somewhat unduly concerned as to the estimation others make of him. However, he spontaneously recognized this and seriously sought to discipline himself in regard to it. This feeling did not work out as a craving for sympathy or as an undue concern about his physical health. Socially he showed no restrictions. He enjoyed people and was at ease with them. He is not stubborn. He takes advice well. He is frank and open, not a day-dreamer and he showed no inclination to phantastic schemes or plans.

His feeling of insecurity appears again in an inclination to be slightly oversensitive, yet he was quite free from any distorted habits, such as jealousy and suspiciousness, based on it. It is also shown in a tendency to worry, though on the whole he is light-hearted and cheerful. He is free from unfortunate display of temper. He gives no evidence of habit distortion referable to sexual or instinctive interests. He is not prudish, not effeminate. He is quite open and natural with women. Finally, he is naturally interested in healthful physical diversions.

Comment.—In this personality we therefore see little evidence of poor adaptation in traits indicating habitual evasion or emotional absorption. He displays a feeling of self-insecurity and, though he adapted himself well toward it, it led to somewhat unfortunate results by causing him to work perhaps too industriously and under tension, to have too much regard for the opinion others held of him, and to worry somewhat unduly. His adaptability is further somewhat favorably documented by a ready appreciation, after his recovery, of his needs and a sensible attitude of correction toward them.

CASE 2.—History.—Another similar case is that of a woman who developed a deep delirium immediately after a confinement. She became a little restless and received morphin and later hyoscin, both in considerable amounts. She then, like the preceding patient, became hallucinated, restlessly and aimlessly active, quite disoriented, misinterpreted her surroundings and displayed a marked paraphasia. She showed also the same momentary mental clearness on being roused. She displayed, too, a similar directness and transparency of behavior, though she showed a rather strong tendency to occupy herself with fancies centering about other possible marriages she might have made. She recovered after about three months.

The patient, aged 35, passed through the period of adolescence without any especial irregularity or odd behavior. At about 8 years of age there were unfortunate sexual experiences which emphasized interests to which she adapted herself well, yet which nevertheless remained more or less in the

foreground. She had an uneventful, broad, rather full and efficient life up to her marriage at 27.

She had a stepson to whom she devoted herself happily, but owing to financial restrictions she denied herself children though she was eager for them. Nevertheless, she remained naturally happy. Later indications revealed that she allowed her fancies some play in the direction of what wider opportunities would have brought if she had married some one else, but this did not appear to modify her behavior or mood. On the whole, her adaptation appeared quite satisfactory.

Personality.—Her personal make-up, too, was quite clear and transparent. Intellectually, she was above the average. She is alert and a good manager. Perhaps she was a bit overtalkative, but was not overactive otherwise, and on the other hand she was by no means lacking in energy. She was not only free from stubbornness, but she profited by her mistakes and adjusted herself well to the plans of others without at the same time being too malleable. She was well liked socially, though it is said that she was inclined to devote herself to a few intimate friends rather than to seek a wide acquaintance. Nevertheless, she was quite at ease with strangers, quite tactful, and free from petty sensitiveness and jealousy. She was quite frank and open. Her mood was evenly cheerful. She did not worry. She took hardships well. She was not irritable. She was, however, rather easily startled by thunder and loud noises, but otherwise was not inclined to have fears. She was not bashful. She was quite naturally and frankly affectionate and passionate, but plainly guided this well, except possibly for a tendency in later years to indulge a little in fancies as stated above. She was naturally interested in healthy diversions.

In this case, too, we see a well-adapted individual. She displays a distinct, but on the whole healthy, passionate nature. Except for a tendency to let her fancy play and for a possibly too easy acquirement of contentment, we can scarcely criticize her capacity for adjustment.

For psychiatric interests it is fair to conclude that these two cases represent instances of average good adjustment. The terms used in a systematic description of them are those which tend to indicate, on the one hand, a not undue absorption or distraction interfering with a free disposal of energy on occasion of need, and those, on the other hand, which tend to show that the individual, automatically or consciously, tends to protect himself, to compensate habitually for deficiency in one field by activity in another, or by the employment of evasive traits.

In sharp contrast with this open, frank type of individual whom we instinctively trust, I wish to describe two patients who have, perhaps, a minimum range of adaptability compatible with average living conditions.

CASE 3.—History.—The patient, a man, aged 32, is employed as a clerk in a large metal business. He was a free, active, careless boy. At 9 he began to sing in a church choir. From about this age until he was about 17 he was out late at night, visited pool rooms and kept rough company. All this he did in disobedience to his parents. At 17, suddenly and immediately after

his father's death, he reformed. He became quiet, expressed regret for his former behavior, lived a strict life, and neglected physical exercise for his music. From about a year after this and continuing four or five years he complained of his stomach. He went from one physician to another, and thought he was going to die. At 20, he showed a good deal of animosity toward a fellow clerk who advanced more rapidly than himself. At 22, he became infatuated with his cousin and became so angry at his brother for calling on her that he left home for two or three days. Later he showed a more or less intense interest in particular women, but he dropped them suddenly one after another much to the mystification of the women and his family. At 25, he thought an old friend was conniving with another employee to injure the patient's standing with his firm. From now on he kept more and more on his guard and was more or less continuously in inward turmoil, which culminated in his admission to the hospital in an acute paranoiac episode. This development was in close relation to a feeling of guilt and apprehension concerning a habit, he had practiced for years, of getting into crowded street cars and allowing himself to be pressed against women passengers. He developed into a typical paranoid dementia praecox.

Personality.—His personality is characteristic. He is intellectually bright. He was closemouthed, but was a hard worker. He was inordinately proud and particular in personal appearance beyond what would naturally be expected. He was hypochondriacal. His leading characteristic was his unwillingness to take advice. He held his opinions stubbornly and would not acknowledge his faults. He had few friends, was not easily approachable. His behavior toward others was characterized by a whimsical changeableness. He was suspicious, jealous and envious. He was serious, readily became apprehensive. In matters relating to sex he was formally correct to the point of being strictly on his guard, but apparently he did not develop, as many do, a prudishness; on the contrary, he displayed a prurient hypocrisy. He had no virile diversional interests. He devoted himself narrowly to his music.

Comment.—This case is a very simple example of the so-called "shut-in" personality. The traits cited nearly all have the function of preventing any one from peeking over his private personal enclosure. He cannot receive advice, for he has so frail a sense of self-security that the admission implied in receiving correction or advice would tend to shatter his self-confidence and lead him too painfully close to an appreciation of his limitation.

CASE 4.—History.—Another case is that of a woman, aged 38. She was admitted after she had been distinctly abnormal for about three years. At the time of her admission she displayed much scattered aggressiveness. There was also a marked reduction of judgment in even simple, practical matters. She occupied herself with other people much to their detriment, but this she failed to appreciate. She developed poorly systematized delusions of persecution. She became quite inaccessible, and at opposition or even at attempts to guide her, she became violent to a degree which rendered her antisocial. She was regarded as a case of paranoid dementia praecox of very gradual development.

She developed normally and after an academic schooling and some training in physical culture she taught Delsarte in the Middle West. At about 21 she became engaged but broke this engagement when she met her present husband, who was then a minister. At this time she had a tic which consisted in a loud hemming in the throat and which persisted for several years afterward.

She was married at 24. Her husband soon drifted away from the regular church and finally became a Christian Socialist. The patient opposed this vigorously. She gave as the chief reason that they would be social outcasts and would also be in precarious circumstances financially, neither of which was the case. Quite soon her husband established a good reputation and she at once began to exploit it for gratification of her social desires.

Personality.—As a girl she is said to have learned readily, but her attention was never very steady and early in her married life she said her mind wandered. She was never an accurate observer. She did not acquire a facility for adapting herself to work, which did not at the time afford her abundant satisfaction. She ruled her parents and other members of the family and did not know how to deny herself. She would not take advice and would not recognize her mistakes, and was firmly stubborn. She made friends readily but with one or two exceptions, did not retain them more than a short time. She has never been frank and when her weak points are touched, especially her lack of domesticity and maternal feeling, she either becomes angry or—to use her husband's expression—"shuts up like a clam," that is, she ignored them. She had moody spells which she is unable to account for and a temper which is violently excited by the slightest opposition. She differs, however, from most people of her type by quickly recovering from her temper and in being forgiving.

Comment.—Here, therefore, long before the onset of the psychosis, we find a vigorously developed faculty for evasion of adaptation and the most highly developed mechanisms for securing the evasion are those which constitute the chief features of the psychosis.

Earlier Personal History.—When she was about 30 years of age and eight years before she was admitted to this hospital, she began to pay much attention to abstruse philosophical problems, and in this she did not prevent herself from very cheap imposition. At about this time, her natural absent-mindedness began to be gradually more exaggerated. This was also the time of a lull in her husband's affairs. He had become more radical and to some extent was deserted by former supporters. The patient at this period had a vision in which she saw an elderly and wealthy gentleman whom she fancied would support them in their work. From this time on she has had occasional hallucinations. When the news of this wealthy gentleman's death was brought to her she claims to have heard his voice say, "Trust me my child." Some three years before admission her husband practically abandoned the church. He bought a farm and devoted himself to literary work. The patient was now much distressed at the situation. She was more or less isolated in the country, occupied with family cares for which she had no interest. Moreover, her husband was away from home much of the time. She began to worry lest some calamity befall her husband. She spent money foolishly and made elaborate presents without justification. She insisted on having her way and was unmanageable. While under observation she displayed an impenetrable resistance to all efforts to lead her to adapt herself. If met casually, she usually behaved with gracious but shallow heartiness. If, however, one attempted to guide her she became resentful, told how her children need her and what they are missing in her absence, and soon fell into a passion.

These same dangerous traits must, however, be interpreted entirely within the setting in which they occur, as in the following case, which recovered.

CASE 5.—History.—The patient was 31 years of age when admitted to the hospital. She was a healthy child and was reared in a crowded district in New York City and apparently under few elevating influences. She stopped school at 14 and was left an orphan between 15 and 16. From this time until her marriage at 22 she worked in a laundry. She remained well except for headaches which resembled a migraine and which ceased after her marriage. She went out nights a good deal and was inclined to be a little sporty. She had, however, only one intimate girl friend. She associated more easily with men than with women.

After her marriage she dropped her friends and made no new ones. Soon after her marriage, also, she displayed a rather gross jealousy of her husband. During the next eight years she bore several children and had numerous miscarriages. There were financial hardships also, but on the whole, except for a growing jealousy of her husband and a general willingness to be somewhat careless in her housework, she appeared to get on well enough.

About five months before admission she had her chest examined. She has had a return of the headaches she had before she was married. She then began to worry about herself, became a little absent-minded and finally definitely absorbed. She smiled a little to herself. About a month before admission she referred to her physician as if he were in some way hostile toward her. She spoke of hypnotism in this connection. A little later she said she was ashamed to look the doctor in the face. A few days later she said a girl who sat in front of her at the theater said something about her husband. Shortly after this she began to say that God spoke to her. Two days before admission she was unusually dreamy. She said she had a vision in which God addressed her as his St. Anne. A few hours afterward she became excited and said her physician was cutting up her husband.

Personality.—On admission to the hospital she was mentally clear, but continued to hallucinate and to persist in her delusions. For a short period she became rather excited and, at the time referred to, her delusions which had a decidedly erotic tinge, plainly served to obscure her own longings about which she had a sense of guilt. She at first displayed a considerable absorption in her ruminations, and on one occasion there was for a few hours a catatonic-like state with waxy flexibility. More and more a depressive affect now came into the foreground. The hallucinations and delusions retreated and she recovered in ten weeks, but without satisfactory insight.

Intellectually she was up to the standard of her family and class. She was a good manager. Nevertheless, she was naturally not talkative and was somewhat indolent. She was very conceited, proud, and overindependent. In her associations with others she showed considerable restraint. She had few friends and was a little backward socially. She found it very difficult to take advice, was headstrong, wanted her own way and could not face her mistakes. She was jealous, sensitive and naturally suspicious so that she had ideas of reference, thought others talked about her. She was not frank. She was quite imaginative, but it was not determined to what extent she day-dreamed. It was known that she neglected her work to read novels. Her mood was naturally variable. She worried, felt abused, displayed tantrums of temper. She was vigorously passionate, liked to be petted, but was restrained and found it difficult to express her feelings to others.

Comment.—This personality closely resembles that of the two foregoing cases. They are all on the defensive and exhibit the correlative traits of that attitude. The last case, however, is in a degree less pronounced than the other

two. Her adaptability allowed her to meet her difficulties perhaps not half way, but nevertheless far enough to keep within a corrective distance of reality most of the time. That she displayed the symptoms she did can only be taken as further documentary evidence of a perilous exercise in the evasion of facts, and it places her adaptability close to the danger zone.

The foregoing cases represent instances in which the imperative to adaptation was urgent. There was in the first two of the just preceding three cases no middle ground at which it was comfortable to arrive. They had to adapt or were obliged to adopt a more or less completely overwhelming subterfuge. That adaptation may be avoided without such subterfuge is amply illustrated by the cases of dementia praecox which slip away without marked trends. The two following cases represent variants of this general type.

CASE 6.—History.—The first of these is a man, aged 40. He was reared in relative luxury in a family in which there were traditions of aristocratic comfort and ease. He had a personal servant from an early age, but developed no tendency to snobbishness. He was a happy, care-free boy. He went to boarding school early, and from 15 till 17 played a good deal, in an innocent way, and studied little. Then family reverses began and he went, at 18, to prepare for professional work. He worked rather hard and was a general favorite.

He finished his professional training at about 24. His father now died and the patient was obliged to shoulder responsibilities for a large family. He worked dutifully but was not happy. He longed for wider contact and he wished to specialize in his profession. He managed to do this. He lived up to and a little beyond his income. In this way and by being more obliging to others than he could afford, he was in continuous discomfort. After a disaster in his family he was much distressed, had difficulty in sleeping and on several occasions took a little chloroform. Then he took a small dose of morphin. Within a week or two he was taking morphin daily. Then he spent several months getting rid of it, but two years later after his child died, he began again and continued until he came to the hospital.

In the estimation of his friends he was a charming and successful man and though not one of great force, nevertheless a man who inspired confidence.

Personality.—The study of his personality served to shape more definitely the suggestions in the history. There is no question but that he was above the average intellectually. He was subject to enthusiasms, but they usually burned themselves out rather quickly. He was self-depreciatory but at times reacted by a show of stubbornness, especially if it were a question of gratifying a strong desire. Socially he was unusually adaptable—even too much so—as he did favors for others he could not afford to do and was timid lest he offended others. He cooperated well and was reasonably frank and open. He was very imaginative and sentimental. He was naturally cheerful but has mood changes downward and revulsions against application to his work. He was very affectionate. Toward matters of sex he is rather prudish. He has few virile interests. He was strongly attached to his church and holds a simple, childlike faith in it.

Comment.—This patient is therefore an individual with a marked intolerance of tedium and discomfort. He has a strong attachment to simple moral ideals developed in a chaste, sentimentally dominated home atmosphere. He

has never faced his problems carefully, but has drifted along instinctively. He is exceedingly docile and takes the line of least resistance, though when his trend in this direction is reinforced by a positive wish, he is capable of being quite stubborn. He is, in other words, an individual who describes the curve of his life docilely about a center of emotional fascination. In this particular case the fascination stood in an individual of otherwise relatively good adaptability.

In a companion case the same general mechanism works out more unfortunately.

CASE 7.—History.—This patient is a man of 45 and of whom very careful anamneses were taken from several different sources. These indicated that he was on the whole an exemplary, somewhat retiring boy. He received highest prizes for scholarship in school. He went to a well-known college. He was supplied by his father with all reasonable necessities, yet he on one occasion stole money and property from other boys. This was patched up. He finished college and took up a law course. While at this he appropriated for his own use a small amount of money entrusted to him for other purposes. He entered the practice of law and did chiefly an office practice. He became much respected and was known as a man who was able to settle differences out of court. He was intrusted with numerous fiduciary accounts. He was particularly kind and went out of his way to do a good turn for others. He was much depended on in his church. It was apparent that in his inclination to help others he was a little gullible. He was a little extravagant in his way of living.

Slightly suspicious indications were carefully followed up, and it was found that not long after his marriage at 28 he became mixed up with a woman and there were suggestions of affairs of the same nature later on from time to time. At 39, it is known that he drank some. At 44, it is known that on one occasion he was intoxicated. His income probably at no time exceeded \$2,000. Just before admission it was discovered that he had appropriated for his own use—by forging—funds intrusted to him by clients. Soon it was found that these speculations had been extending over many years and were considerable in amount. In a somewhat careless way, from period to period, he robbed Peter to pay Paul and then took from Paul to replace what he had taken from Peter.

Personality.—He is an individual who, after this revelation, would pass as an arch-hypocrite. Yet if hypocrisy implies a conscious false pretense for a clearly worked out purpose he is no more an hypocrite than an hysterical patient is. He is really an individual at the mercy of his tendencies.

A systematic study of his personality showed that intellectually, on the side of acquisition, he was up to the average of his family, if not above it. He was, however, impractical, planned poorly or not at all, and was a poor observer. While his attention appeared good (and on formal test proved to be so), he was rambling in his talk and seemed to have a subnormal capacity for coordinating his data. He was always more or less hesitating in his opinions. This intellectual lethargy had its correlate in his physical activity which was quite scattered. While he had little impulse to physical activity, he nevertheless kept busy doing what in the case of an orderly man would have been unnecessary.

Consistent with this he was self-depreciatory, lacking in self-reliance and generally timid. He was very sociable and made acquaintances readily. For this he apparently relied on a very responsive, sentimental sympathy which,

while it was awake, quite completely dominated him and led him into promises which he fulfilled only at considerable sacrifice. As a boy it was learned that he was obedient, but secretive. He was tactful, but it was the tactfulness of one who yields without planfulness and, currying favor in this way, accepts whatever this sort of near-wheedling happened to bring him.

He was not frank. In a way this conception is not applicable to him. He is a good example of an individual who by a certain careless procrastination is always in arrears and is so busy juggling expedients that he seems to himself too occupied to be able to take time to see himself and his affairs in any correct perspective. He was too close to them. He worked in a hard, uneconomical way and attained no satisfaction from it. He never got ready to be frank.

His mood was quite closely parallel with the ups and downs of his affairs. He often appeared worried, again on slight provocation he saw things in very rosy colors. At home he was often pettish and displayed a spoilt-child behavior. He had a poor sense of humor.

He was very sentimental. As a boy he was always in love. He is a day-dreamer. His fancies went far afield and had a strong sexual coloring. He took alcohol to encourage them.

Comment.—The personality status and a somewhat careful analysis made later, indicate a strong fascination capable of competing favorably against a natural inclination to reality. He surrendered in a considerable measure. His real life became a sort of fiction. His wish fancies covered over reality in such a way as to deprive him of a clear vision of the seriousness of his misdeeds. He would not in clear consciousness have injured any living thing but by a little indirection he was led to rob widows and orphans. This fascination also makes clear why he was not a good observer, why he was not practical, why he was not energetic, and why he had a sense of insecurity with traits developing from that. He is a constitutionally inferior individual and was obliged to go to prison.

OBSERVATIONS

The forger, while evidently subject to the same disabling difficulty as the preceding case, is plainly much more disabled. The most obvious, and perhaps the most important difference between the two cases is that the first one was occupied with fascinations which, though auto-erotic in character, still remained, after a fashion, objective—if that is not a contradiction in terms. His interests are, to a large degree, centered about chaste, domestic, sentimental ideals which lend themselves in some measure to specific objective embodiment. The forger, on the other hand, was occupied with fascinations more of an imaginative, subjective type. He confessed that he was much occupied with erotic fancies. He was so subject to the tendency as to fictionalize reality in a mild way. For his own welfare it must be said that his compromises, or, perhaps better, his compensating activities—such as devotion to personal service, sentimental loyalty, and objects of an altruistic nature—tended to offset by somewhat practical contact, his tendency to unreality.

To illustrate a still more pernicious extension of this tendency I wish briefly to present another case.

CASE 8.—History.—This patient was 29 years old when admitted to the hospital. It was stated that as a child he appeared normal enough, except that he did not remember his lessons and that at about 10 he developed a tendency to be quarrelsome. At 17 he failed college entrance examinations. His father bought a manufacturing business for him to grow into and finally own. But he took little interest in it, left it and wandered off into this and that enterprise, always unsuccessful, always gullible. He drank and dissipated some. Finally he reformed and became religious. He gradually developed delusions, and said eventually that Astor was God and that he was Astor's son, Christ. Finally he showed very florid wish-fulfilment delusions tinged with homosexuality. There was no acute episode. He drifted along serenely. Remained quite clear and was just grandiose and patronizing enough to tell about himself very fully.

Personality.—The personality analysis covering a time well antedating the distorted behavior representing the psychosis, describes him intellectually as poorly retentive, though he appeared to grasp things well enough. He was impractical and appeared to expect the world to lend itself to interpretation in his rather juvenile terms. He was lacking in energy, though he had enthusiasms, which, however, soon spent themselves. He was a little overbearing and "chesty." Socially he was somewhat snobbish. He was not stubborn, but on the contrary rather too pliable. He was free from malice. He day-dreamed to a marked degree. Was serious minded and inclined to have the blues. His fancies ran luxuriantly to sexual topics. There were contrary sexual tendencies.

He said, and there seemed to be no reason to doubt his very consistent statements, that at as early an age as 5 he had sexual thoughts and soon afterward thought of girls in an erotic way. At 7 or 8, probably after seeing his father exposed, he felt as if he must look at the genital region of men. It troubled him. He felt he was dirty. He frequently said his peculiar tendencies made him feel different from other boys. Apparently he developed a marked feeling of self-depreciation in relation to it. He showed also, undoubtedly as a reaction to it, a behavior of superiority toward his family. He belittled the culture of his family, admired the refinement of aristocracy and became haughty and disdainful and very precise. He said he always felt restricted and penned in and never felt happy. He always felt as if he were under a cloud.

Comment.—This case represents an extreme instance of habitual surrender to the auto-erotic. He had essentially no objective application of his interest. He worked over his world into romantic juvenile terms. From the standpoint of adaptability this general type of case is to be estimated by the degree it is intellectually practical, physically energetic, and the extent to which he has interest to dispose on objective reality. This type of case emphasizes the general observation that lack of mental and physical energy, other things remaining equal, is usually to be accounted for by an emotional satisfaction or indulgence which short-circuits it.

GENERAL CONSIDERATIONS AND CONCLUSIONS

The cases cited have, I believe, illustrated practically all the traits of personality important in routine practice, and the cases also suggest the adaptive correlates of the traits. The cases, in addition, illustrate

two general types of personality. One may be described as presenting a strong impulse to adaptation, and, failing of adaptation, is prone to develop traits of personality representing extreme measures of evasion. The other type is that in which the impulse to adaptation appears to be more or less neutralized. The characteristic traits of this type are those of hebetude and romantic dreaminess.

The types of personality intermediate between these extremes, those in which adaptation is distinctly partial, I have not represented. They would include those who break down in the manic-depressive way, the psychoneurotic fashion, and those of that miscellaneous remainder we are content to refer to as the psychopathic inferiors.

It will have been noted, and perhaps with some question, that a systematic study of the personality is, in a way, only an emphasis laid on a special feature of the anamnesis. A good history would probably include practically all that would be inquired about in a systematic study of the personality. That which makes an anamnesis satisfactory is the degree to which it gives a satisfactory status of the personality. There are a number of reasons, however, for still keeping a sort of special department of the history for the personality status. These reasons have to do with the informant, the patient, and the person who takes the history. A history properly taken in such a way that it adequately and progressively cross-sections the patient's life from point to point, is an undertaking which relatively few have the patience and aptitude for, and on the whole one secures better uniformity if the inquiry as to the make-up is concentrated into a special corner of the anamnesis.

TREATMENT OF DEMENTIA PRAECOX BY INTRA- VENOUS INJECTIONS OF SODIUM CHLORID

TOGETHER WITH STUDIES OF THE CHLORIN CONTENT OF THE BLOOD

WILLIAM C. MILLER, M.D.

WARREN, PA.

Kraepelin¹ noted that sodium chlorid infusions caused an increased appetite and thirst, and improvement of the general health of cases of confusion and restlessness. Ishida² administered a 0.9 per cent. common salt solution intravenously, as far as circumstances permitted, in ten cases of dementia praecox. In five untreated cases of catatonia the quantity of chlorin in the blood was tabulated. The amount varied from 0.199 to 0.220 per cent. (Estimations made by Professor Horinchi by the Volhard-Salkowski method.) Ishida calls attention to this low chlorin content of the blood and says, "I am led to infer that common salt in the blood in catatonic patients as well as those with other clinical forms of dementia praecox might be deficient, and that the infusion of physiologic salt solution would meet this deficiency, though the results might be but transitory." As the result of treatment of the ten cases he concludes that "in nearly 50 per cent. of all cases I have observed the awakening of interest in work directly following treatment. Remissions have been observed in four cases; the longest duration being four months." Fever occurred in some instances after the infusion was given. Ishida suggests that this might be due to impurities of the solution as a result of defective sterilizing methods.

Guthrie,³ in a paper read at the fiftieth annual meeting of the West Virginia Medical Association, stated that he followed Ishida's suggestions and gave normal salt solution intravenously. He reported the results of treatment of fifteen cases based on chemical analysis of the blood. These analyses showed a deficiency of sodium chlorid. Of the fifteen cases, ten, "very unclean before treatment, were improved in this respect. In eight cases, there was an awakening in interest in work directly following the treatment, and in seven of these cases this was continued. . . . Seven cases were greatly improved . . . One apparent cure . . . since treatment was commenced five and

1. Kraepelin: *Psychiatric* 1:623, Ed. 8.

2. Ishida: *Am. J. Insan.* 73:541, 1917.

3. Guthrie: *Dementia Praecox, Observation and Treatment*, Fairmont, W. Va.

one-half months ago. This patient has put on 25 pounds in weight and improved mentally to a surprising degree. All fifteen patients showed increase in appetite for food and all gained flesh. All fifteen patients showed more or less improvement in their disposition. No elevation of temperature or bad symptoms of any kind developed after the injections."

Guthrie does not give the figures obtained nor the methods used in the making of the blood analyses. Later⁴ he recorded condensed notes of five of the fifteen cases treated and stated the amount of salt solution used. No blood analyses were given.

AUTHOR'S OBSERVATIONS

Ten cases of dementia praecox were selected for treatment at the State Hospital, Warren, Pa. Blood analyses were made on all cases as well as on a number that were not treated. The salt solution used was made 0.9 per cent. strength in freshly distilled water. The sodium chlorid used was free from sulphates, alkaline earths and heavy metals, magnesium, iodids, potassium, iron and ammonium. The tests for the determination of these substances were those recommended by Krauch in "Chemical Reagents, Their Purity and Tests," 1907. The following methods were used in making the blood analyses:

Urea, Van Slyke and Cullen;⁵ nonprotein nitrogen, Folin and Denis;⁶ creatinin and creatin, Myers and Fine;⁷ glucose, Lewis and Benedict;⁸ calcium, Lyman;⁹ chlorids, Harding and Mason's¹⁰ modification of the McLean-Van Slyke method;¹¹ cholesterol, Weston.¹² Blood for analysis was collected in the morning before the patients had had breakfast and was analyzed at once.

The accompanying table shows the amounts of the various constituents found in the blood of the treated cases before treatment was begun.

There was practically no variation in the figures obtained from analyses made before treatment and those made three days after treatment. It will be seen from the table that the values found are within the normal range. Analyses of blood from untreated cases of dementia praecox, manic-depressive insanity and epileptic psychoses gave practically the same figures as those shown in the accompanying

4. Guthrie: *Dementia Praecox Studies* 1:61, 1918.
5. Van Slyke and Cullen: *J. Biol. Chem.* 19:211, 1914.
6. Folin and Denis: *J. Biol. Chem.* 26:491, 1916.
7. Myers and Fine: *Chemical Composition in Health and Disease* p. 19, 1915.
8. Lewis and Benedict: *J. Biol. Chem.* 20:61, 1915.
9. Lyman: *J. Biol. Chem.* 29:169, 1917.
10. Harding and Mason: *J. Biol. Chem.* 31:55, 1917.
11. McLean and Van Slyke: *J. Biol. Chem.* 21:361, 1915.
12. Weston: *J. Biol. Chem.* 28:383, 1917.

table. In the cases here reported there was no deficiency of chlorin in the blood and there was no deficiency in any of fifteen other cases examined. The blood examinations were made by the hospital pathologist, Dr. Paul G. Weston.

Intravenous injections were made by the gravity method. The initial dose was 3 c.c. per kilogram of body weight. Each succeeding dose was increased by 30 c.c. and injections were made at seven-day intervals for a period of four and one-half months.

The diagnosis of dementia praecox was made at the staff meeting. Long abstracts of the case histories are, therefore, not given.

THE AMOUNTS OF THE VARIOUS CONSTITUENTS FOUND IN THE BLOOD OF THE TREATED CASES BEFORE TREATMENT WAS BEGUN

Case	Number	Mg. per 100 C.c. Blood					Per Cent.		
		Non-protein Nitrogen	Urea Nitrogen	Creatin	Creatin	Calcium	Glucose	Chlorin as Sodium Chlorid	Cholesterol
1	8346	23.5	18.50	1.71	4.20	6.00	0.101	0.484	0.150
2	7576	20.6	15.50	1.53	4.10	5.62	0.091	0.500	0.175
3	8917	24.7	15.65	2.12	5.20	5.50	0.110	0.525	0.150
4	6900	25.0	17.50	2.30	5.40	6.15	0.106	0.506	0.160
5	7331	25.2	17.45	1.90	4.60	7.25	0.095	0.491	0.175
6	7771	26.5	16.70	1.75	4.75	7.75	0.092	0.522	0.170
7	7308	27.6	15.40	2.10	5.00	7.75	0.106	0.537	0.155
8	5945	28.0	17.50	2.25	5.20	6.00	0.112	0.519	0.180
9	8278	28.1	17.80	1.90	5.00	8.00	0.095	0.494	0.180
10	8642	26.3	18.20	2.15	5.80	5.50	0.108	0.480	0.155

SUMMARY OF CASES AND RESULTS

CASE 1 (8346).—Age, 31. Diagnosis: Dementia praecox, hebephrenic; duration, seven years.

Condition at Time of Treatment: Indifferent, apathetic, tidy in habits.

Result: Mentally, brightened up slightly; physically, gained 7 pounds.

CASE 2 (7516).—Age, 28. Diagnosis: Dementia praecox, catatonic; duration, four years.

Condition at Time of Treatment: Resistive, mute, untidy.

Result: Mentally, none; physically, gained 15 pounds.

CASE 3 (8917).—Age, 33. Diagnosis: Dementia praecox, hebephrenic; duration, fifteen years.

Condition at Time of Treatment: Evasive, irritable, confused, tidy.

Result: Mentally, appeared brighter and wanted to work and did reasonably good work; physically, gained 12 pounds.

This patient escaped after the last treatment had been given.

CASE 4 (6900).—Age, 24. Diagnosis: Dementia praecox, catatonic; duration, ten years.

Condition at Time of Treatment: Denudative, destructive, extremely untidy.

Result: Mentally, none; physically, lost 1 pound.

CASE 5 (7331).—Age, 32. Diagnosis: Dementia praecox, hebephrenic; duration, eleven years.

Condition at Time of Treatment: Apathetic, indifferent, tidy in habits, careless of personal appearance, hallucinated.

Result: Mentally, practically none; physically, gained 2 pounds; slight general improvement.

CASE 6 (7771).—Age, 38. Diagnosis: Dementia praecox, catatonic; duration, seven years.

Condition at Time of Treatment: Resistive, mute, untidy.

Result: Mentally, none; physically, gained 5 pounds.

CASE 7 (7303).—Age, 28. Diagnosis: Dementia praecox, catatonic; duration, eight years.

Condition at Time of Treatment: Mute, apathetic, indifferent, tidy.

Result: Mentally, practically none. There was slightly less apathy. Physically, general health improved, 14 pounds gained in weight.

CASE 8 (5945).—Age, 31. Diagnosis: Dementia praecox, catatonic; duration, twelve years.

Condition at Time of Treatment: Denudative, destructive, filthy.

Result: Mentally, no improvement; physically, gained 2½ pounds.

CASE 9 (8278).—Age, 27. Diagnosis: Dementia praecox and imbecile; duration, eight years.

Condition at Time of Treatment: Indifferent, apathetic, untidy.

Result: Mentally, none; physically, none.

CASE 10 (8642).—Age, 34. Diagnosis: Dementia praecox, hebephrenic; duration, from six to nine years.

Condition at Time of Treatment: Resistive, mute, untidy.

Result: Mentally, brightened up slightly; physically, gained 7 pounds.

SUMMARY

Mentally.—Seven of the ten patients showed no mental improvement; of the remaining three, two brightened up slightly, the third brightened up enough to work.

Physically.—Eight of the ten patients gained in weight from 2 to 15 pounds; one patient lost 1 pound and one patient remained stationary.

The blood of twenty-five patients was examined for chlorin content and in none was there a deficiency.

THE BEARING OF WAR NEUROSES ON IMMIGRATION

LAWRENCE. KOLB, M.D.

Passed Assistant Surgeon, U. S. Public Health Service

ELLIS ISLAND, N. Y.

Early in the present war an excessive incidence of functional nervous diseases was noted among the troops of all the belligerents, the handling of which constituted a major medico-military problem. The occurrence of similar neuroses among civilians subjected to the adverse influences in the war is probable.

It is expected that after the war many aliens who have suffered from war neuroses incident to military service or residence in devastated areas will apply for admission to this country. It will be the duty of medical examiners to detect these persons if abnormal and to determine what disposition from the standpoint of medical certification shall be made of them.

This paper is intended to deal chiefly with the latter aspect of the subject, but in order to arrive at a clear understanding of the war neuroses in relation to immigration it will be necessary, first, to inquire into their nature and incidence and to review the etiology and clinical manifestations of the disorders embraced by this term.

NATURE AND PREVALENCE OF WAR NEUROSES

Salmon reports that in the British Army mental and functional nervous disorders have been responsible for one-seventh of all discharges for disabilities, or one-third of all discharges if wounds are excluded. He estimates that the admission rate for insanity among the British Expeditionary Forces is about four per thousand as compared with a rate of two per thousand among the nonexpeditionary forces, and one per thousand among the adult civilian population of Great Britain. The insanity rate has not been as high, however, as in recent wars, and Salmon believes that the war neuroses are taking the place of the psychoses in modern war, this being in part due to the failure in previous conflicts "to recognize the real nature of the severe neuroses which are grouped under the term 'shell shock' in this war." Again he says, "it is certain that in the early months of the present war many soldiers suffering with war neuroses were regarded as insane."

While no reliable reports from any of the belligerent nations have been received indicating an unusual prevalence of nervous diseases among the civil population, it is probable, as stated in the foregoing,

that emotional causes relating to the war have precipitated mental and nervous disorders in some members of this class who by reason of inherent nervous instability were strongly predisposed. Civilians of healthy nervous constitution or those showing neurotic tendencies only of such mild degree that they are able to weather the unusual stresses of peace times have not, on the other hand, seemed to be adversely affected by the war. This may be accounted for by the fact that in civil life a man even in the war zones never has to endure such long continued danger, discomfort and fatigue as the soldier in the trenches. The former can alter his mode of living so as to get relief from the situation before it becomes unbearable, while the latter has no choice but to endure until relieved or until a breakdown intervenes.

Among the many features of the war which have tended to precipitate mental and functional nervous disorders none has been more potent than the continued bombardment with high explosive shells to which most of the sufferers from these conditions have been subjected. Many soldiers have developed neuroses immediately following the explosion of a shell in close proximity to them as a result of which they were knocked down, partially buried, had their comrades killed or suffered some other injury either mental or physical.

The frequent occurrence of this sequence of events led early to the coinage of the term "shell shock," which later came to be used as a diagnostic term to cover the whole group of functional nervous disorders and was even loosely applied to obvious cases of insanity. This term is unsatisfactory and misleading because many clinical types are covered by it. Moreover, it implies a single etiology acting instantly, whereas in reality, the train of symptoms which precedes the final breakdown that an explosion precipitates is often long and distressing and the causes producing them are varied. Many soldiers have developed their neuroses away from the firing line. In others doing duty in the trenches the condition has appeared under circumstances which allow the direct immediate effect of explosions as a causative factor to be completely excluded. For these reasons most writers on the subject prefer the term "war neuroses" to "shell shock," and they would limit the term to those functional nervous disorders whose etiology or symptomatology bears some direct relation to the war.

In addition to the neuroses which have been caused or colored by the conditions of war, many cases of a purely civilian type have developed among soldiers. These latter have all occurred in unstable individuals, most of whom would have developed a neurosis following some difficulty in civil life. Probably all cases which occur in the home forces and most of those who go to pieces after a few days at the front belong to this class of inferiors.

ETIOLOGY OF WAR NEUROSES

Hereditary defects and physical and mental causes are responsible for the development of the war neuroses. All observers admit the liability of each of these causes, but depending on their viewpoint, they attach different degrees of importance to them. Those who lay great stress on the physical factors, place a large proportion of cases in the category of those due to "injury of the nervous system without physical injury." Explosions have caused death in numerous instances without leaving any signs of external injury. Necropsies done on such cases have shown multiple punctate hemorrhages in the substance of the brain and spinal cord. It has been estimated that the force generated by a 17-inch shell is equal to 10 tons to the square yard, and Major Mott¹ thinks that in some cases, sudden death may be due to the transmission of this aerial compression to the ordinarily incompressible spinal fluid causing shock to the vital centers of the floor of the fourth ventricle resulting in arrest of the functions of the cardiac and respiratory centers.

Decompression with liberation of gases suspended in the blood causing emboli of nitrogen and carbon dioxid it is thought may also be responsible for some of the instant deaths. In addition to direct aerial compression concussions may be caused indirectly by the soldier being thrown through the force of the explosion against the side of a trench, or by having sand bags fall on his head or spine, or by having the roof or wall of a dugout blown in on him. The same author² points out the similarity of symptoms in severe cases of shell shock with burial to those observed in carbon monoxid poisoning, the effects of which are not always transitory and are sometimes permanent, and he thinks it possible that while lying unconscious at the bottom of a trench or dugout sufficient carbon monoxid generated by shells or mines is inhaled to cause those severe effects which some of these cases exhibit.

The victims of war neuroses are often found to have low blood pressure and other vasomotor disturbances. This lends weight to the theory that some disturbances of the functions of the ductless glands may be responsible for these conditions. Many symptoms of the gastric and heart neuroses suggest the same etiology. It is possible that endocrinitic disturbances may be important in the production of all neuroses. Little, however, is known about this and other physiologic factors that may later be found to be the true fundamental basis for these disorders.

1. Mott, F. W.: Effects of High Explosives on the Central Nervous System (Lettsomian lecture No. 1), *Lancet*, London, 1:331, 1916.

2. Mott, F. W.: Effects of High Explosives on the Central Nervous System (Lettsomian lecture No. 2), *Lancet*, London, 1:545, 1916.

ESSENTIALLY PSYCHIC IN ORIGIN

Those who view the subject from the psychological standpoint, while admitting the importance of physical causes in reducing the nervous resistance and in precipitating the acute symptoms, regard most of these cases as essentially psychic in origin. Undoubtedly many soldiers of sound constitution and normal make-up and in whom there is no trace of faulty heredity, have developed neuroses after long duty in the trenches. In some instances men have passed successfully through other wars, but have broken down under the strain of this one.

The explanation for the occurrence of these disorders in individuals otherwise healthy is to be explained, in part at least, by the extreme state of nervous exhaustion which results from long continued duty in the trenches with its dull monotony and exposure to incessant noise and constant danger from exploding shells, and with no chance to relieve pent up emotions by any compensatory active operations.

In addition, the soldier has to endure wet, cold, thirst and hunger; he is disgusted by rats, lice and foul odors from dead bodies; he is made miserable by the bites of flies and other insects, frequently horrified by the sight of his comrades killed and mangled, and in many cases, suffering from nostalgia or worried by the turn his affairs at home may be taking. A condition of fatigue develops which is characterized by insomnia, irritability, difficulty in concentration and a tendency to jump at any sudden noise. Going to sleep is made difficult by the appearance of visions of fighting which come up before him whenever he begins to doze off and which he is unable to banish. When sleep is accomplished it is disturbed by troublesome dreams.

Often as the symptoms grow worse there is a loss of the sense of direction of shells, fear is then naturally increased as all shells seem to be coming toward him. Life under these conditions becomes so intolerable that the soldier wishes to escape and, as no other means seem possible, he longs to be captured or wounded. In some cases there is a genuine desire to be killed. When this stage is reached some additional factor, physical or mental, precipitates the neurosis in an acute form and provides the soldier with the relief from duty which he craves. So strong does this desire become that it is said some who receive painful, incapacitating wounds show no signs of suffering or regret, but give way to expressions of genuine joy, and it has been observed that the reception of a wound does not at the time cause a neurosis, although hysterical symptoms centered around this wound may later on develop in those who consciously or unconsciously desire to avoid further active duty. For instance, a soldier enjoys several weeks rest in consequence of having been wounded in the arm. The

idea of recovery with the return to the trenches is distasteful to him, and when the bandages are taken off it is found that he has a functional paralysis of the arm. In other words, the fundamental psychologic basis of war neuroses is a desire for relief from an intolerable situation. In consequence the soldier develops symptoms which affect his ability to fight and serve to keep him away from the trenches. In many instances the bursting shell with its attendant horrors acts merely as the "last straw" in precipitating a neurosis in one whose resistance has already been weakened by the excessive strain to which his nervous system has been subjected. In some individuals with a neurotic tendency, a mild concussion is all that is necessary to bring on an attack.

ESPECIALLY FREQUENT AMONG OFFICERS

In proportion to their number more officers than privates develop war neuroses. The officer has to attend to work requiring mental effort which interferes with his rest and increases fatigue. The responsibility of command and the efforts he must make to hide all signs of fears keep him in a state of constant nervous tension. These additions to the strain the private has to bear favor the more rapid development of that state of nervous exhaustion which is the forerunner of the neuroses in so many cases. They may explain also in part, at least, the relative frequency said to occur among officers of that form of neurosis in which insomnia and anxiety are such important features. This form is apparently a further elaboration of the condition commonly known as neurasthenia which occurs among civilians following certain exhausting influences.

SYMPTOMS

Most of the neuroses that develop at the front are ushered in by some disturbance of consciousness following an explosion. These disturbances may be organic or functional in character. As previously stated the relative importance of physical and psychic factors in their causation has not been definitely determined. Apparently, severe functional neuroses may develop in those who have suffered only slightly from concussion or the inhalation of poisonous gases.

Disturbances of Consciousness.—The disturbances of consciousness vary in different cases from a slightly confused or dazed condition to complete unconsciousness. Some patients remain in a stuporous state for hours and days. Some regain consciousness when brought to the clearing station, but remember nothing of the explosions or subsequent events; others wander from their comrades, and when questioned are unable to account for their movements. In quite a number of instances when soldiers have been brought in unconscious and subsequently

were unable to give any account of what happened, some of the forgotten events have been recovered by hypnotism. In consequence hypnosis has been suggested as a means of differentiating between organic cases and those which have been induced psychologically.

Anxiety Neuroses.—Following the period of unconsciousness a state of anxiety ensues or the patient develops some hysterical symptom. MacCurdy in his admirable article on the war neuroses classifies them in two main types—"condition of anxiety on one hand, and of simple conversion hysteria on the other."³ The anxiety neurosis is often merely an acute exacerbation of symptoms which have already existed. The soldier who develops this condition emerges from unconsciousness only to pass into a delirious state in which he imagines himself fighting again. Auditory and visual hallucinations of a terrifying nature occur; soldiers are charging toward him with bayonets; mines are exploding under him or he hears shells shrieking through the air, all of which seem to be coming directly toward him. In this situation he may show all the signs of extreme fear; the pupils are dilated, the respirations shallow, the body covered with a cold sweat and trembling violently. Flight may be attempted or the power of voluntary movement entirely lost. In some cases for days the body is maintained in a crouching position while dodging movements of the head and defensive movements of the arms are made. As improvement occurs the symptoms gradually become less severe. Insight is gained into the unreality of the visions, but any sudden noise such as the whistle of a locomotive or slamming of a door is interpreted as an explosion and causes the patient to start with momentary fright. Terrifying dreams relating to fighting occur during the acute stage, and after the hallucinations subside these dreams continue, making sleep a torture. A few minutes sleep may mean the appearance of such a nightmare from which the soldier awakes in terror. Naturally, fear of sleep develops and little is obtained. This increases the fatigue and retards recovery. By degrees the dreams become less severe and their character may change from those in which he is powerless and invariably defeated to those in which he is able to punish the enemy and get some satisfaction from the fighting.

The acute symptoms usually subside after a few weeks, but in some severe cases continue for several months. Sensitiveness to noise is likely to remain for a long time. When all objective symptoms have disappeared the patient is still nervous and fearful that some accident will happen. He has a feeling of incompetency and is likely to consider himself a coward and be mildly depressed.

3. MacCurdy, J. T.: (Psychiatric Institute of the New York State Hospitals) War Neurosis, *Psychiat. Bull.*, July, 1917.

In addition to those mild cases of concussion causing transitory symptoms only and out of which the severe neuroses emerge in soldiers who have already begun to show symptoms of nervous exhaustion, there are a number of severe cases in which the symptoms undoubtedly point to concussion as the chief if not the only causal factor. In these organic cases there is a period of unconsciousness which varies in duration in different cases, but which may last for several days. On recovering consciousness the patient does not, as a rule, remain clear but is likely to pass through a period lasting several days, during which he repeatedly drops off into unconsciousness again. Usually in this stage control of the bowel and bladder reflexes are lost and, when conscious, severe headache is complained of. Following concussion there may be such a complete loss of memory that the patient is unable to remember his name or where he lives. In all severe cases there is poor memory, difficulty in collecting the thoughts and defective orientation. Any mental operation causes fatigue and is likely to be performed incorrectly. After recovering consciousness these patients pass through a delirious stage which does not differ greatly from that previously described for the neuroses following some mental accident superimposed on fatigue, but the anxiety symptoms are likely to be less severe.

Hysterical Cases.—All the hysterical manifestations observed in this war are common among civilians in time of peace. In this disease there is a condition of extreme suggestibility, and it is said that a patient predisposed to it may develop any abnormality of function of which he is aware. The mechanism which brings about the peculiar dissociation of consciousness resulting in these symptoms varies, but the basis for them among soldiers is dissatisfaction with their work and a desire to escape from it. Those whose nervous system has been rendered susceptible by neuropathic heredity more readily acquire the losses and perversions of function characteristic of hysteria, but the surprising number of normal soldiers who have developed them under the influence of war seems to bear out the assertion that it is a disease which is potential in every one.

Preliminary symptoms of nervous exhaustion are not as frequent or severe as they are preceding the anxiety state, although some fatigue symptoms often precede the onset. An emotional shock or physical injury acts as the precipitating cause; often it is a mild concussion or partial burial with earth blown up by an exploding shell. A momentary period of unconsciousness ensues and the patient awakes to find himself with an hysterical symptom. One of the patients observed on Ellis Island had fallen unconscious on the anticipation of a German attack. He awoke mute, and when seen by us some months

later, his voice was little more than a whisper. Mutism followed by some degree of aphonia is the most common symptom. Functional blindness had followed the witnessing of horrible sights, and *anomia* develops as a defensive reaction against foul odors. These latter symptoms and functional deafness, however, are not very common.

Disturbances of voluntary functions are important; they include paralyses of various kinds, contractures, tremors, convulsive movements and gait disturbances. Many of these cases occur in previously wounded soldiers after recovery from the physical injury. The idea of paralysis following injury is a common one; expectant attention is directed toward the injured member and the symptom develops in consequence of the autosuggestion brought about in this way. Pains, anesthetics and functional visceral and circulatory disturbances are frequent.

There is no sharp dividing line separating the anxiety cases from patients suffering with pure hysteria. Those patients whose disabling symptom is hysterical in nature frequently have suffered from a moderate degree of nervous exhaustion, and complicating the hysteria, they show in a mild degree, some of the signs of fear previously described. On the other hand, many of those in whom symptoms of anxiety are most prominent have as a complication some hysterical manifestation, or such symptoms develop during recovery from the anxiety state. Marked tremors are especially characteristic of this form of neurosis, and gait disturbances are said to be more common as a complication of it. In some degree tremor occurs in every anxiety case. It affects chiefly the hands and feet, but may involve any part of the body.

AIDS IN TREATMENT

Mention of treatment is necessary here only as throwing light on the final outcome of war neuroses.

Rest is of first importance in the anxiety states. Persuasion, suggestion, discipline and reeducation by physical means are successfully used to restore confidence and remove symptoms. Suggestion under hypnotism cures some cases, and in many instances symptoms have suddenly and permanently disappeared, following some sudden surprise or emotional shock.

In all cases an effort should be made to give the patient a clear understanding of the origin and nature of his disorder. The most important step toward permanent recovery has been taken, once the patient is convinced there is nothing fundamentally wrong with him and understands that the symptoms from which he suffers have arisen because of his dissatisfaction with the war.

Psychoanalysis as specially understood and applied by Freud and his school has not been used. There seems to be no particular reason for employing this method in the treatment of the war neuroses.

By reason of the nature of these affections and as a result of utilizing the remedial measures mentioned many cases recover even under war conditions. It is generally thought when peace is concluded and all fears of being again forced to fight are dispelled, most cases with previously normal nervous constitution will speedily recover.

NERVOUS STABILITY OF FUTURE IMMIGRANTS

In considering the effects of the war on the mental and nervous stability of future immigrants this likelihood of recovery as well as numerous other factors are to be borne in mind. Undoubtedly, it is true that some strong individuals have collapsed under the extraordinary burdens they have had imposed on them by war conditions, and, both in military and civil life, many weak ones have given way under the strain. Furthermore, the large number of men engaged and the magnitude of the operations has contributed to an excessive prevalence of functional diseases in this as compared with all previous wars. In consequence it might be thought, because of the strain of the war on both the civil and military populations of the nations recently fighting each other that when peace is concluded the immigrants we get from them necessarily will have a somewhat weakened nervous constitution, and, to this extent, at least, the present and future generations of America will suffer because of the introduction of this alien neuropathic element.

A close analysis of the subject, however, seems to show that these fears are not well grounded and the reverse is more likely to be so. Physical hardships and mental trials when they do not destroy are likely to strengthen those who battle with them. Work, discipline, deprivation, self-sacrifice and striving for victory will strengthen the minds and morals of a people that has survived the trials incident to those things. In the case of the weak, war has only precipitated a condition that was potential in the individual, and it cannot be held responsible for producing a condition that already existed. On the contrary, by bringing weaknesses to light, in many cases it will enable us to discover and reject inferior aliens who ordinarily might have passed without question.

Viewed in the light of what has been said then, it seems that in so far as the nervous stability of future immigrants is concerned, we are likely to be benefited both by the strength the war produces and by the weakness it reveals. In arriving at this conclusion, we assume, of course, that in addition to the work previously done to bar undesirable immigrants from the country, special efforts will be made to detect

and reject those whose inferiority has become evident through some accident of the war.

In addition to certain sufferers from neuroses many mild psychotic and borderland cases of insanity who are able to get along unnoticed in civil life, as well as those who have a reduced resistance in their nervous system due to alcohol, syphilis and previous nervous exhaustion, have had their defects brought boldly into relief by the intense emotions and physical strain associated with warfare. The same may be said of those other potentially insane immigrants who, because of some inherent weakness, go to pieces and find their way into an insane asylum soon after their arrival in this country.

It may be mentioned here that a few writers on medico-military problems seem to think that certain types of psychopathic offenders have been improved by the discipline of military life and have become good soldiers. This is greatly to be doubted. It has long been observed that the truly psychopathic character adapts himself poorly to military life even in times of peace, and the results obtained with him in this conflict seem clearly to show that he is unsuited for war. It is probable that nearly all of those so-called psychopathic offenders who became good soldiers were not psychopathic at all but accidental offenders and other transgressors, who became violators of the law, not because of inherent defects of instincts or intelligence, but because of unfavorable environmental influences. The same discipline and regulated life which brings out the true worth of this class tends to expose the defects of the real psychopath.

DETECTION AND CERTIFICATION OF WAR NEUROSES

In dealing with immigrants whose mentality or nervous constitution has been adversely affected by the war, our first care will be to detect them and separate them from the normal as they pass before us for inspection. In any ship-load of aliens the officer who attempts to detect the insane and psychopathic individuals labors under a serious handicap because of the limited time at his disposal, the language difficulty, the lack of histories of cases that might come under suspicion and the natural motive of the alien and his friends for concealing his infirmities from the medical examiners. Again, it is well known that in some stages of certain forms of insanity and in most psychopathic individuals, the conduct and conversation of the patient during any short examination may be such as to enable him entirely to escape suspicion. The importance is thus seen of investigating every case especially alien soldiers discharged as medically unfit, as to the particulars of any past illness to determine whether it was a manifestation of nervous instability. The clue which we often will have that the alien has suffered with some form of nervous disorder will be a valu-

able addition to the resources usually at our command for the detection of this class of diseases. This clue should be looked for and carefully followed in all cases.

After discovering various cases we must determine how they are to be certified, and in doing this for the war neuroses we should be guided in each instance by the possible effect of the neurosis on the patient's future efficiency, and what primary inferiority underlies the disorder itself. In some cases it will be found that no inherent weakness is responsible, the disorder being directly determined by the conditions of warfare.

The diagnosis "war neurosis" of itself will not necessarily exclude any one from the country, and it is not desirable that it should do so. It goes without saying that many of this class will become desirable citizens. Immigrants so diagnosed, however, should at least be regarded as having a condition which may affect their ability to earn a living. Their admission or rejection will then depend on other factors considered along with the medical certificate.

CLASSIFICATION OF UNDESIRABLE ALIENS

In order to make the rejection of the truly undesirable aliens certain, they should be certified in classes whose deportation is mandatory under the law. All the idiots, imbeciles, feeble-minded, insane, epileptics, persons of constitutional psychopathic inferiority or with chronic alcoholism come under the "excluded classes." Hence, the importance of diagnosing these conditions as such instead of merely accepting them all as cases of war neuroses pure and simple. It is presumed that no idiot or imbecile has been accepted for service in any of the armies, but many epileptics, psychopathic characters and high-grade mental defectives have been, and these furnish a considerable proportion of those who eventually break down under the strain of military life.

In order to be able to detect and exclude these inferior individuals without including among them some of those whose neurosis from the standpoint of eugenics and the social adaptability of the immigrant concerned is comparatively benign in nature, we should have as clear an understanding as the present knowledge on the subject will allow us of the nature and cause of war neuroses in general, and then make a particular study of the life history and development of each patient who comes before us to determine whether the condition arose on a background of some form of constitutional inferiority. This should be done for the recovered patients as well as for those who still show some symptoms.

All observers admit that individuals who show neurotic tendencies in times of peace are less likely than the normal to adapt themselves

to war; and some think, that except among the neuropaths and psychopaths, few war neuroses occur. Among the symptoms which have been put forward as indicating neurotic tendencies or an abnormal make-up are night terrors and fear of the dark when a child, fear of thunder, a feeling of discomfort or uneasiness when in a tunnel or high place, or undue horror of cruelty and bloodshed and shyness with the opposite sex. However important these symptoms and others of similar nature are as indications of a neurotic constitution, without other manifestations of psychopathic tendencies, they surely cannot be used as the basis for certificate of constitutional psychopathic inferiority under the immigration law. A very large proportion of the civil population in whom there has never been a nervous breakdown and who show no evidence whatever of psychopathic tendencies exhibit one or more of these so-called neurotic symptoms, and to classify them as psychopathic or inferior would be manifestly absurd.

In classifying these cases we should bear in mind then, that the soldier who develops a neurosis away from the firing line or after a few days at the front is more likely to be truly neurotic or inferior than one who gives way under the strain only after long exposure to the special horrors of trench life.

EFFECTS OF SEVERE CONCUSSION

In those persons previously normal who have suffered severely from concussion and have had long periods of illness in consequence, it is likely that considerable damage has been done to the finer structures of the brain, and even after apparent recovery we may expect the mental tension in some cases to be somewhat lower than it was before the injury. Again, it has been noted that following severe cerebral concussion there is often change in character. Such changed persons are invariably worse and never better. They are more egoistic, irritable and selfish than they had been and are prone to outbreaks of rage on trivial causes. On rare occasions actual insanity may result. In some instances the concussion merely lets loose a latent tendency to the disease. In others the injury seems to be solely responsible. The insanity may come on months after the concussion, but a record of the intervening period will always show some evidences of change of character.

Following all cases of "shell shock," whether due to concussion, gas or mental causes and regardless of whether or not recovery seems complete, the individual's resistance is lowered; he is less able to stand the stress of life than he was before, and, in consequence, is more susceptible to mental and nervous disease. But, there is no reason to believe that the germ plasm is affected by acquired con-

ditions of this kind, and in so far as eugenics is concerned, no harmful results need be feared because of the special injury that has been received. Unless procreation occurs during the period of acute illness, it is probable that the children of parents so injured are no more likely to be neurotic than they would have been if the weakness of their parents as shown in the neurosis had never been revealed by their terrible experiences with war.

From what has been said there seems to be no doubt that every case of war neurosis should at least be certified as having a condition which may affect ability to earn a living. The point to determine is when to go further and give a certificate of constitutional psychopathic inferiority or other form of certification which requires deportation.

In some previous wars, there is no doubt that too many nervous cases were regarded as insane. The great interest aroused by the neuroses in this conflict is likely to cause the pendulum to swing the other way. In the inspection of immigrants it is important to avoid this reaction. After the war discharged alien soldiers will come before medical officers of the public health service for examination claiming to have had shell shock or war neuroses, but in reality presenting the whole range of mental and nervous disorders from general paralysis to hysterical tic. The inspection will be poorly done if a stock diagnosis of "shell shock" or war neurosis is accepted or if all war neuroses are regarded as of equal significance. While many of these aliens will make useful citizens some of them, if admitted, will become a financial burden to the state; others, in addition, will transmit neuropathic taint to future generations. We should then be prepared to deal with each case on its own merits so that the purposes of the immigration law may be fully executed and the best interests of our country served. An effort should be made in all cases to determine whether a certificate for feeble-mindedness, epilepsy or insanity can be issued.

CONSTITUTIONAL PSYCHOPATHIC INFERIORITY

When all afflicted with these disorders have been disposed of there will remain a certain number who can be certified as persons of constitutional psychopathic inferiority. By reason of the application of this term in law and the relationship its manifestations have to war neuroses some mention of it here is necessary, but the various types of character that may be included in this class will not be discussed at length. Often a full life history is necessary before the diagnosis can be made. In the usual inspection of immigrants this is not often sought for because the patient does nothing to arouse suspicion of his abnormality.

Lack of adaptability to war is an important clue to the constitutionally inferior. Among soldiers malingering, desertion and other breaches of discipline as well as the development of neuroses often indicate a deep-seated perversion from the normal mental and nervous constitution. Some of the anomalous characters which may be included in this class show defective intelligence, but aside from these there is an important group in the borderland between sanity and insanity who are "failures of mental adaptation" and have a tendency to become actively disordered. Here we find the constitutional psychopaths and inferiors, the moral imbeciles, the pathologic liars and swindlers, the defective delinquents, many of the vagrants and cranks and persons with abnormal sexual instincts. The dividing line between these various types is not well defined and for purposes of simplicity in classifying the mentally abnormal immigrant they may be included in one general class and certified as cases of constitutional psychopathic inferiority.

Persons with physical defects or anomalies alone and without mental peculiarities should not be certified as constitutionally inferior. A certificate of this kind means that the individual so certified has some instability of his nervous system which affects, or is liable to affect, his psychic life.

These individuals may have a fair amount of intelligence, but they are emotionally unstable and show weakness of judgment, eccentricities of behavior, undue suggestibility and defects of character. Their make-up favors the development of psychoses. They are easily unbalanced and under the stress of difficult situations or even of ordinary social conditions, episodes of excitement or depression occur or they may have hallucinatory attacks or develop paranoid trends. In addition to the types mentioned in the foregoing, the regulations governing the medical inspection of aliens says that any well defined case of psychasthenia or hysteria should be certified in this class.

PSYCHASTHENIA

Under the heading psychasthenia are included those morbid personalities who are afflicted with irresistible ideas and fears. The phobias, obsessions, doubts and impulsions characteristic of this disease are evidence of a deep seated "psychopathic inferiority" which is transmitted by heredity. The symptoms take on a variety of forms and are of varying degrees of severity. Common among them are the various phobias such as fear of high places, enclosed spaces, open spaces and crowds. There may be real apprehension arising from fear of all kinds of disease and danger, which in most cases the patient on reflection recognizes as unreasonable and absurd but which he

nevertheless is unable to resist or control. Among the symptoms that make these patients miserable are fears that they will commit suicide, or a crime, or make obscene remarks, or be guilty of some other indiscretion. The psychasthenic has no impulse to do these things; the crimes would be repulsive to him and in consequence he seldom, if ever, carries out the action he fears. On the other hand, there are patients who have real morbid impulses the execution of which gives a certain sense of satisfaction. To this class belong those who have an irresistible desire to steal or set fire to things and other so-called manias.

In studying the personality of a suspected immigrant to determine whether he is inferior under the meaning of the immigration law, we should bear in mind that every obsession or impulse that might be called psychasthenic is not of itself sufficient to justify a certificate of inferiority. The degrees of this condition shade off gradually from those who are but little separated from insanity to the normal. Beyond a certain point in the scale, a certificate of constitutional psychopathic inferiority would no longer be justified. In defining this point no hard and fast rules can be drawn. It is necessary for the officer to exercise his judgment in individual cases.

Any symptom or set of symptoms that disables, distresses or brings the patient in conflict with the law should be regarded as evidence of psychopathic inferiority. Many of the milder obsessions and impulses probably mean nothing. The man who has an impulse to count windows and other objects, or who must rise from bed to see whether he really locked the door, or the doubter given to wondering about the nature and existence of God and other abstract matters is not because of these things alone to be considered constitutionally inferior. It is probable that in many cases these and other mild symptoms similar in nature are acquired by faulty habits of mind and in a biologic sense they do not indicate any deviation from the normal. On the other hand, the person always has an inferior personality, who, after passing his friend on the street is tortured by the idea that he might have killed him, thinks he probably did kill him, and is unable to banish the thought from his mind, although he knows full well that he has done no such thing. Symptoms like the foregoing or other manifestations of psychasthenia of equal importance arise always on a background of congenital psychopathic inferiority, and we need not hesitate about certifying immigrants who are or have been afflicted with them as cases of constitutional psychopathic inferiority.

HYSTERIA

Hysteria in its many manifestations is of less importance as an indication of psychopathic inferiority than the disorder just described. The constitutionally neurotic readily acquire the disease, and in them its manifestations are more varied and it is more difficult to control than in persons who deviate but little, if at all, from normal nervous stability. Many of the severe cases arise through the instrumentality of heredity and are indications of degeneration, but with sufficient provocation disabling symptoms of this disorder may occur in persons of faultless heredity and normal nervous constitution.

In a paper of this scope it is not possible to discuss the manifold symptoms of hysteria and point out the various combinations of symptoms that may be taken as evidence of constitutional psychopathic inferiority. The truly degenerate hysteric has unstable emotions and his intellectual processes deviate in several particulars from the normal. Before issuing a certificate of inferiority we should look for these stigmata in addition to the evident derangement of physical functions. A study of the family history to determine the presence or absence of neuropathic heredity will throw light on many otherwise doubtful cases.

Monosymptomatic hysteria is much less likely to be evolved from an inferior constitution than other forms in which numerous changing symptoms occur. For this reason it is more amenable to treatment, and when cure is effected it is more likely to be permanent. This is illustrated by some cases occurring among soldiers at the front in whom one symptom such as mutism or paralysis quickly and permanently disappears. The persistence of symptoms should not, however, be regarded as a sign of constitutional inferiority. By faulty methods of treatment or for other reasons cure is often delayed in what might otherwise be simple cases. With such a patient the idea of permanent disability becomes so deeply rooted in his mind, that the symptoms have a tendency to become fixed and are extremely difficult to remove even with the most careful treatment.

A certificate of constitutional psychopathic inferiority should not be issued lightly. When we study an immigrant with the end in view of giving a certificate of this kind we should bear in mind that within certain limits a nervous type of temperament is not pathologic, and even when the bounds of normality have been passed psychopathic inferiority is not in all cases to be inferred.

In speculating about things in the mental field there is hardly any limit to the tendencies and types of character that have or might be called psychopathic, but when practical results are sought for and the law is to be complied with the circle embraced by this definition must be restricted within reasonable limits.

Obituary

JAMES JACKSON PUTNAM
1846-1918

With deep sorrow we record the passing of Dr. James Jackson Putnam, who died of angina pectoris on Nov. 4, 1918. A more adequate sketch and appreciation will appear in a future number of THE ARCHIVES, but it is fitting that we should now pause and give a thought to the personality and career of this great man.

Dr. Putnam was born of distinguished ancestry, in Boston, Oct. 3, 1846. After a liberal academic and medical education he at once became a pioneer and a leader in his chosen field of neurology. For the rest of his life he was a leader and like all great leaders an ardent follower of his ideals. Having a great store of accurate knowledge, he was as well a real thinker, a man of ideas and of sound judgment in the application of knowledge to practice. In short, he was a wise man as well as a savant. For his having lived, the science of medicine is more profound, the art of medicine finer and more exact. And in particular, American neurology deprived of Dr. Putnam's contributions, would be many steps behind its present creditable place. But his almost unique position was not that alone of a fine scientific machine and a great intellectual power. He was a big souled, lovable gentleman. None can think of his attainments and his use of them without an inner uplift.

Abstracts from Current Literature

CONTRIBUTIONS TO PSYCHOTHERAPEUTIC TECHNIC THROUGH PSYCHOANALYSIS. SMITH ELY JELLIFFE, M.D., *Psychoanal. Rev.* January, 1919.

Stressed is the need of extension and refinement in the technic of psychotherapeusis, made apparent by the increasing mass of material referred to this field for help and with a stimulus toward such a goal presented in the striking advance of procedure in other branches of medicine. A brief generalization of this division introduces Freud's contribution, here summarized in a relation of therapeusis to the affect.

The importance of psychoanalysis for further departures in therapy justifies a condensed presentation of its main aims. Psychotherapy is an attempt to get back into the stream of the psychic movement and depends on reeducation and redevelopment in the sense of a readjustment. The analysis of dreams should be pursued, not merely as a means of recovering buried complexes, but, following Jung, the prospective trends involved in dream structure are to be utilized as suggesting a possible constructive effort toward a better adaptation, for the dream presents an apt index of such wishes and the manner of directing them. Technical advances in therapy, then, consist not merely in disorganizing unconscious tendencies, but in a direction. A further specification of possible ways to effect this follows. In the location of the point of break a closer attention is desired both to effect a release of the fixation and to discover implied suggestions there resident, for redirection. The lines of individual interest are not to be forgotten nor may one overlook in this location the particular compensations here brought about, defining the structure of the neurosis beneath which are to be discovered the less obvious clues for further procedure.

In view also of the obvious attempt of the neurotic to mend himself, Jelliffe defines reading as of service, not for diversion or literal instruction, but rather as offering for appropriation by the patient better openings for wider interests. Instruction may give also a clearer handling and interpretation of new and definite facts to supplant the constant wandering in the midst of the diversities and shadows which form the usual neurotic content. A better specification of analytic help and its function is here defined, a thing of importance in view of current loose psychotherapeutic advice. Too often there has been missed any insight into the patient's deeper unconscious interests whose diversity defines an equal diversity in respective mental evolutions.

A brief reference follows to the endocrinal relations in which the psychic impulses, driving to individual and social ends, indicate the mind as a field where the disturbances reside and the initiating factors arise. The somatic and environmental influences are thus placed in a larger setting throughout which operates the striving and affects of the individual.

In a definitive way the writer, in the paradigm of *praecox*, develops a method in which, beside the patient, there is also present a trained attendant, between whom and the analyst is carried out a discussion to which the patient may more easily adjust because of his position outside of it. The adjustment is made more possible by way of the excessive affect thus being permitted a gradual release. While *praecox* presents a problem of special affect situations

with a maximum withdrawal of interest and a total inclusion of all affect at one site, guarded under conditions of intensity, other situations occur in the psychoneuroses where similar modifications of technic are applicable. Nor is the applicability to be derived only from the type of neurosis, but also from the general characteristics of the patient. That is, the point of approach to the patient is to be solved with anything but a universal formula.

Some such flexibility of concept as to procedure is needed if the technic of psychoanalysis is to evolve. Hence the readily apparent significance of this article.

PARKER, New York.

THE REFLEX FUNCTIONS OF THE COMPLETELY DIVIDED SPINAL CORD IN MAN, COMPARED WITH THOSE ASSOCIATED WITH LESS SEVERE LESIONS. GEORGE RIDDODCH, M.D., Brain, Lond. 40: Parts II and III, 264-402, 1918.

The numerous cases of spinal injury during the war have given an unprecedented opportunity for investigating the functions of the cord, and Riddoch has availed himself of the chance to study very carefully and thoroughly a number of cases of transection of the cord proven by operation or necropsy. Studies such as these have given the *coup de grace* to the so-called Bastian-Bruns law and have proved that under favorable conditions, the part of the cord below the level of the lesion not only can recover its reflex functions but does often become highly excitable. Full credit must be given to Sherrington and his supporters who first clearly stated that the flaccid paralysis which occurs after complete division of the spinal cord in man and the higher apes—which differs so markedly from the condition of the isolated cord in lower animals—is due to the greater intensity of “spinal shock,” and that the apparent difference is only one of degree. All this and more is clearly set forth in Riddoch’s historical review of the subject.

The stage of spinal shock corresponds to the period of muscular flaccidity and, in three of Riddoch’s patients, lasted from one to three weeks (a much shorter period than in our experience is usually the case). During this period myotatic irritability though diminished, is never lost, although all voluntary muscles below the level of the lesion are paralyzed and all cutaneous and tendon reflexes are absent except that reflex contractions of the anal and vesical sphincters can still be obtained. If the lesion is above the sixth thoracic segment all abdominal visceral sensations are absent; if the section is between the sixth and eighth thoracic, abdominal sensations are referred to the epigastrium.

In the stage of reflex activity, flexion reflexes elicited by scratching or pricking the soles of the feet are usually the first to appear. Whether or no they are unisegmental, as claimed by Gordon Holmes, is still an open question. They persist for a varying period of time and are followed by upward movements of the toes accompanied sooner or later by contractions of the flexors of the hips and knees, the adductors of the thighs and the dorsi flexors of the feet, and the “mass reflexes” contractions of the abdominal wall muscles, evacuation of the bladder, sudden and profuse sweating, etc. The earliest involuntary movements to be observed in the legs are flexor in character—the elementary reactions to nocuous stimulation. During this stage of increased reflex activity, it is possible to obtain healing of bed-sores. The patients may remain in this condition for an indefinite period, but sooner or later pass into the last stage. In the third stage—usually due to toxic febrile complica-

tions and an indication of approaching death—there is a gradual failure of the reflex functions, the threshold value of stimuli is raised, mass reflexes can no longer be evoked, flexor spasms of the lower extremities disappear; there is muscular wasting, a greatly increased tendency to decubitus and perhaps retention of urine and feces. Finally no reflexes of any kind can be obtained.

In a separate chapter, Riddoch makes a comparison between the manifestations in complete division of the spinal cord and those found in some less complete lesions. In certain cases of incomplete injury to the spinal cord the application of a nocuous stimulus to the sole of the foot causes a flexion reflex of the lower limb, but the reaction differs from the "mass reflex" of complete division in that the flexor movement is less violent, that it is invariably accompanied by a crossed extension reflex, that the abdominal wall is involved in the motor response with only intense nociceptive stimuli and that the receptive field of the flexion reflex extends only up to the knee.

In complete transection of the spinal cord, there is never an active extension of the lower extremity when the foot is dorsi-flexed after the limb has been passively flexed, and there is never an extension of the lower extremities by nocuous stimulation of the upper parts of the thighs, of the perineum or genitals. These extensor movements correspond to the "extensor thrust" described by Sherrington in decerebrate and spinal animals. The clinical picture, from the reflex point of view, resembles the "paraplegia in extension" described by Babinski and Walshe, in contrast to the "paraplegia in flexion" of complete division of the spinal cord.

Finally, Riddoch devotes a chapter to a consideration of reflex activity—to the factors which influence it, to muscular tonus, and to the reflexes as adapted reactions. The quality of the stimulus is an important factor in determining the character of the reflex movement. Nocuous stimuli are most effective and the stronger the stimulus, the more vigorous is the reaction. A stimulus in itself subliminal, if repeated several times in quick succession, will evoke a reflex action. The locality of the stimulus is of more importance in incomplete than in complete lesions. General fatigue, prolonged states of toxemia or septicemia from urinary sepsis, bed-sores, etc., have a profound effect in depressing the intramedullary parts of the reflex arcs which latter have an important bearing on reflex activity.

In the stage of muscular flaccidity in transection of the spinal cord, the paralyzed muscles are without tone; in the stage of exaltation of reflex activity, the tone of all the paralyzed muscles in the resting state remains constantly below the normal, but the flexor muscles in both the resting and the contracting states show more tone than their antagonists. These findings correspond to Langelaan's classification of muscle tonus—an absence of the "plastic component" and a retention of the "contractile element" in the paralyzed muscles after complete division of the spinal cord.

The author's views on the reflexes as adapted reactions can be summed up in his own words that the higher centers "dominate the spinal cord in man more than in animals; but the spinal reflex mechanism of the elementary functions of protection, reproduction and excretion, which are the oldest in the phylogenetic scale, still retain some power of autonomous action."

[The author follows Sherrington in his views and opinions. There is much in the article that is proven, some statements that are still a subject of contention and some that must be considered purely speculative. The paper is one that contains much that is interesting and suggestive. The detailed clinical histories are convincing.]

ELSBERG, New York.

ON THE FINER STRUCTURE OF THE SYNAPSE OF THE MAUTHNER CELL WITH SPECIAL CONSIDERATION OF THE "GOLGI NET" OF BETHE, NERVOUS TERMINAL FEET AND THE "NERVOUS PERICELLULAR NET" OF HELD. KIYOYASU MARUI, *J. Comp. Neurol.* 30: No. 1, p. 127.

The author has approached the subject of the finer structure of the synapse by applying to the giant Mauthner cell of certain fish the metal impregnation methods of Cajal, Bielchowsky and Levaditi. Other methods were employed, but practically all of his observations and conclusions are based on the results by these three. The application of the Levaditi method for staining the spirochetæ to the finer structure of the nerve cell is held to be new.

The author reviews in some detail the various opinions and interpretations of the fine netlike incrustation which can be demonstrated at the surface of the nerve cells. This is the structure which Golgi observed in specimens stained by the method which bears his name and which Bethe called the Golgi net in his honor. Apathy described a network of neurofibrils in the invertebrates formed by multiple division and anastomosis of the components of adjacent fibers. Bethe considered that the Golgi net of the vertebrates was the analogue of this neuropil of Apathy's and claimed a continuity existed between the terminal arborization fibrils of one cell and the intracellular neurofibrils of the cell with which it was associated. Held from his studies claimed the existence of two types of investing network around the cell, one of which was made up of anastomosing telodendria, that is, of nervous structure, and the other the Golgi net which he considered to be not of nervous nature. These views, all of which include an anastomosis of nerve fibrillæ from various origins and hence were incompatible with the theory of the structural unity of the individual nerve cell as outlined by Waldeyer in the neuron theory, were vigorously opposed by Cajal who by means of his own methods claimed to be able to resolve Apathy's and Bethe's network into a delicate plexus of fibrils and to demonstrate the continuity of the Golgi net with the "Fullnetz" of Bethe which occupied the spaces away from the immediate surface of the nerve cell. Cajal also denied the direct continuity of terminal filaments with intracellular fibrils and described knobs as ends of the former which lay in contact with the surface of the cell.

Bielchowsky, using his alkaline silver method, saw the terminal knobs which Cajal had observed, but resolved these knobs into a reticular structure and reported that he could demonstrate neurofibrils entering the nerve cell body. Held considered the Golgi net to be continuous with the "Fullnetz" of Bethe and to be of plasmatic glial structure.

The author discusses his own findings in the Mauthner cell under three general heads: (1) The neurofibril structure; (2) the Golgi net, and (3) Held's nervous terminal net, the nervous terminal feet and neurofibril continuity.

He finds little evidence to support Cajal's description of a true net formation of neurofibrils within the cell, but finds them running a straight or winding but continuous course with far too few bifurcations to suggest the formation of a real net.

In the study of the Golgi net the author found that some of his preparations by the Levaditi methods gave exceedingly instructive pictures in that there was a more or less selective staining reaction, the neurofibrils both terminal and intracellular staining a dark brown while the Golgi net and the "Fullnetz" both stained a yellow. This gave opportunity for observation of the relation of these structures which could later be substantiated by Biel-

chowsky preparations counterstained with eosin. The yellow material formed a three-dimensional network whose meshes were four, five, six, and even seven and eight cornered. Where the net lies in approximation to a nerve cell each point of junction of its elements, the nodal point, is connected to the cell body by a thread or beam. This network is reported to be continuous with the perinuclear glia protoplasm. Partially or completely embedded in these plasmatic glial strands are darker stained strands which are interpreted as the arborizing terminal fibrils of distant neurons. That these darker structures are not glia fibrils is indicated by the fact that they are not stained by the selective neuroglia methods and that they could be followed back to a myelinated fiber.

It is unfortunate that we do not possess a technical method which will stain these structures with sufficient intensity for study and at the same time selectively. The metal impregnation stains are irregular in their action and their incrustations frequently obscure the relation of two closely approximated structures. The discordant opinions of various investigators on the structure of the Golgi net is reminiscent of the earlier conception of the neuroglia fibril as a prolongation of the glial cytoplasm derived from metal impregnation methods, the fallacy of which is easily seen when the cells and fibers are stained either by the Weigert method in which the fiber and cytoplasm are differentiated chiefly through the intensity of their coloration or by Mallory's phosphotungstic acid hematoxylin which produces actual selective coloration. Marui's success with the Levaditi method in this regard, if it proves that it can be repeated readily and is not simply an occasional lucky result of the impregnation, will prove to be a distinct advance. The finer structure and reactions of this "tertium quid" of the gray matter, the plasmatic neuroglia, is a subject of live interest both to the morphologist and the neuropathologist. It interferes to a considerable extent with the application to the gray matter of many staining methods which prove most instructive in studying medullary changes and at the same time is most reluctant to take a clear stain itself.

As the foregoing descriptions indicate, the present observations do not accord with Held's view of a pericellular nervous network. No interlacing or intercommunication of neurofibrils is recorded. The terminal feet in suitable preparations resolve themselves into a finely fibrillar structure which does not, however, show evidence of forming a true network. From these terminal feet there project inward into the cell body fine neurofibril extensions. In Cajal preparations this penetration was made out, but fusion with intracellular neurofibrils could not be determined. In Bielchowsky preparations, however, these fine fibrillar projections are reported as fusing with the intracellular neurofibrils, and this not only on the dendrites but on the cell body as well. As evidence that these are not dendritic processes of the cell but rather the telodendritis of distant cells the author claims to have followed them back to myelinated fibers. Unfortunately the reproductions of his photomicrographs illustrating these points are so lacking in clearness of detail that they are by no means convincing.

We are accustomed to consider interneuronic continuity as an established fact in the asynaptic or primitive nervous system of the medusa and in its homologue in the plexus of Meissner and Auerbach, the vascular plexuses, etc., of the higher animals, and here the morphologic evidence is supported by that derived from physiology, wavelike spread of discharge, reversibility of direction of discharge, etc. In the central nervous system, however, the physiologic evidence points toward a surface of separation between function-

ally connected neurons. Sherrington in his "Integrative Action of the Nervous System" gives eleven points which differentiate nerve trunk conduction from reflex arc conduction which he interprets as indicating a physical surface of separation, though not necessarily a demonstrable membrane whose possible activities he outlines in a classical paragraph. Such a surface of separation would be entirely consistent with the results reported in the present article by the Cajal method, that is, between an invaginating neurofibril and the cytoplasm which it is penetrating, but could hardly be brought into harmony with an actual fusion of neurofibrils of extracellular and intracellular origin such as is here described and illustrated by drawings. Considering the constant dangers of interpretation which attend the methods of metallic impregnation it would seem not unreasonable to demand that this observation be confirmed by extension to other types of synaptic nervous tissues, and that it be demonstrated by more than one method before it becomes necessary to reconstruct our hypotheses of the synapse to meet in a new form the known physiologic facts.

ORTON, Philadelphia.

A CONTRIBUTION TO THE STUDY OF EPILEPSY AND BORDER-LINE CASES. H. OPPENHEIM, M.D., *Ztschr. f. gesam. Neurol. u. Psych.* 42: Nos. 3, 4 and 5 (July 31) 1918.

During the past twenty years an attempt has been made to differentiate a variety of convulsive attacks from epilepsy, which were formerly classed as either epileptical or hysterical. As early as 1894 Oppenheim called attention to a variety of convulsions with loss of consciousness, which he regarded as neither hysterical nor epileptic. In 1903 he again directed attention to his former observations, remarking that there was a third variety of convulsive attacks which occurred in individuals with a neuropathic-psychopathic diathesis—individuals who suffered from congenital neurasthenia.

In a later contribution (1905-1906) on psychasthenic convulsions he emphasized the following points:

1. These patients are not epileptics but are to be grouped as neurasthenics and psychasthenics.
2. That these manifestations never occur spontaneously, but are produced by some special exciting factor. These exciting conditions heretofore brought on states of apprehension, congestion or vertigo; their frequent repetition, however, culminated in a convulsive attack.
3. These conditions form, as a rule, only an episode in the course of the affliction; in other words, the attacks are isolated and it may happen that an individual may experience them but once or twice in a lifetime.
- 4 The attack itself may be typically epileptic, but it frequently happens that there are deviations, for example, that in spite of a profound state of unconsciousness the convulsions do not occur or are confined to a single group of muscles or persist after consciousness has returned. Then again the conditions may be similar to petit mal or to the psychic equivalent.
5. Notwithstanding frequent repetitions of the attack the memory and intelligence are in no wise affected or undermined.
6. The attacks are amenable to therapeutic influences although measures directed toward improving the neuropathic diathesis are more efficacious than bromids.

Finally, it was to be remembered that the field of psychasthenic convulsions was an extensive one and ordinary exhaustion neurasthenia is not sufficient to produce these conditions.

This exposition, according to Oppenheim, contains those points on which Bratz based his so-called "affect epilepsy," and likewise those on which Friedmann later developed his "restricted forms" of convulsions. The tendency to restrict the concept epilepsy is traceable to Friedmann's observations. The convulsive attacks described by Friedmann contain three or four features in common with the psychasthenic convulsions described by Oppenheim. These are:

1. That they may appear as attacks of petit mal.
2. That in spite of prolonged duration and frequent seizures the mental faculties remain unimpaired.
3. That the exhibition of bromids is ineffectual.
4. That the manifestations may be transitory.

The essential features of the affection described by Friedmann are:

1. Occurrence in children and juveniles; frequent repetition of attacks (up to 100 a day); loss of consciousness incomplete.
2. Short duration—10 to 20 seconds.
3. Absence of convulsions.
4. Absence of pupillary fixidity.
5. No biting of tongue.
6. No sphincter relaxation.
7. Occurrence on a basis of neuropathic-psychopathic diathesis.
8. Benign course of the disease, particularly unimpaired mentality and possibility of a permanent cure.

Friedmann realized how difficult it was to make a sharp distinction between this variety of attacks and those transitory forms of neuroses associated with clouding of consciousness and pointed out the similarity it had to the narcolepsy described by Westphal and Gelineau; at the same time admitting that similar conditions may develop in hysteria and epilepsy. The attempts of Friedmann to establish a relationship between the frequently repeated minor attacks described by him and epilepsy brought forth considerable opposition.

Narcolepsy is an independent neurosis to be differentiated from epilepsy, hysteria and likewise the attacks described by Friedmann. It differs from the latter in that it seldom occurs in children but usually in adults between the ages of 30 and 40 and mostly in men. Its essential feature is an overwhelming drowsiness that may come on at any time. It is like a normal sleep or cataleptic staring. In this condition, which lasts from a few minutes to half an hour, an automatic occupation may be carried on and obstacles may be successfully avoided. A peculiar feature of this condition is that it may be brought on by hearty laughter, although tickling will not produce it. Gelineau was the first to describe this so-called *geloplegia*—laughing convulsions terminating in sleep. Narcolepsy and *geloplegia* are to be regarded as nosological entities and must be differentiated from *pyknolepsy* and epilepsy, although their general similarity cannot be overlooked.

Oppenheim presents a study of sixteen cases. The first corresponds in minutest detail to the picture described by Friedmann. Inception in childhood. frequent repetition of attacks, duration fifteen seconds, no profound disturbance of consciousness, no manifestation of motor irritability, no falling, no injury, no involuntary urination, no impairment of mental development in spite of the six years duration of the disease, and finally, condition not influenced

by bromids. A disease of this character differs beyond a doubt from petit mal.

The second case resembles the description of Friedmann, though it presents two deviations: (1) the occurrence of motor irritations, and (2) prolonged attacks amounting to status pyknolepticus, analogous to the status epilepticus. This case is to be regarded as one of pyknolepsy.

The third and fourth cases present many points of similarity although there are a few deviations. In the third there was pupillary fixity and some deformity of the skull. There were also local syncope and habitual bradycardia. Likewise the attacks continued to recur notwithstanding that the patient had reached her twenty-seventh year. In the fourth case there are more marked manifestations of motor irritability, also postparoxysmal amnesia. This case also presented slight thyroid enlargement. In the family history the fact was brought out that the parents were related (consanguinity).

To complete this series a fifth case—purely supposititious—of genuine epilepsy is to be added. Then the extremes one and five are separated by an unbridgeable chasm so completely that they may be spoken of as two diseases essentially different, which is in accordance with the teaching of Friedmann. On the other hand, one cannot fail to recognize that these five cases cover a territory in which the transition is so gradual that there remains no differentiating factor between pyknolepsy and epilepsy. One is compelled, then, either to limit the comprehension of the concept of epilepsy in such manner that symptom complexes as found in narcolepsy and pyknolepsy would be excluded. Then, it must be admitted that there is no sharp differentiation to be made and that there are disease varieties and disease forms which belong to borderline conditions, but which gradually blend. Or it will be necessary, on the other hand, to extend the concept epilepsy to such a degree that it will include these various ailments with their resemblances and differences. In this event it must be admitted that epilepsy is a disease of changeable character and such variegated course that there are severe and mild varieties, benign and malignant, curable and incurable, and that each individual case must be judged separately. It is Oppenheim's opinion that it would be more practicable to accept the first alternative and recognize epilepsy, pyknolepsy and narcolepsy as distinct entities, admitting at the same time, however, that there are no sharp lines of demarcation in the field of the neuroses.

The next three observations have in common convulsions of a cortical epileptic type. These three cases have only a superficial relationship and can be utilized if proper caution is observed. The first case is one of unilateral convulsions of psychogenic origin. Although there are no evidences of hysterical stigmata, the fact that an attack could be induced by hypnotism seems to indicate its psychogenic character. This case is therefore regarded as a cortical epilepsy of hysterical or functional form. From these three cases the following essential points are deduced: (1) That these manifestations predominate in infancy and youth, and that the frequent recurrence of the attacks are weight-bearing factors. (2) The atonia and paresis which followed the attacks is not to be attributed to a tissue-destroying disease process, but should be regarded as an exhaustion symptom.

The ninth case shows how difficult it is to judge the essential and causal factor of convulsive attacks. Although the described complaints in this case and the attitude and nature of the patient point to a hypochondriacal character, the convulsions are typically epileptic: profound unconsciousness with cyanosis, stertorous breathing, fixed pupils and biting of the tongue. The attacks

occur at night. The motor phenomena, tonic and clonic convulsions, predominate on the left side. A slight period of confusion precedes the complete return of consciousness. There are some features in this case which seem to indicate that there exists here a combination of hypochondriasis and epilepsy. Certain other features militate against calling it a case of genuine epilepsy: (1) Unconsciousness and convulsions do not manifest themselves at once, but the patient is awakened by some other difficulty, and (2) he feels that an attack is imminent, nevertheless he has time to sound a warning and get to his bed. Although this may take but a short time it is, nevertheless, uncommon in genuine epilepsy. Another peculiar feature of this case is the fact established by careful observation that the temperature of the left side of the body is higher than the right by about 1 C.—an occurrence which must be regarded as a vasomotor disturbance and which cannot be disregarded on account of the unilateral character of the other phenomena.

The next two observations are to be regarded as psychasthenic convulsions. The one may be regarded as rarely occurring epileptic attacks in a neuropsychopath. But it must be noted that in the three attacks this individual had, two were the result of deep emotional perturbation; and that he had the personality of a psychopath and not of an epileptic. The vertigo that troubled him was not epileptoid but the result of phobias (impulses) and occurred only during meals. The other is that of a man, aged 28, who has led a pampered existence from his earliest youth, comes of a neurotic family, is a psychopath, and suffers from tabophobia. He is given to sexual excesses and perversions. One attack from which he suffered was epileptic in character and, notwithstanding that he may experience other attacks, it is hardly correct to regard him as an epileptic. The third had epileptic attacks from his fourth to his seventh year when they ceased and he became subject to *tic generale*. These continued up to the fourteenth year, when there was a three-year interruption until profound emotional excitement brought them on again. This case may be regarded as a myoclonous epilepsy, but the observations were too limited to confirm the diagnosis.

The fourteenth case presents difficulties on account of certain phenomena. The case is that of a man suffering from attacks most probably epileptic in character, but during the convulsions the consciousness was not lost, although there may have been clouding; and then, in spite of seven years' duration, there was no impairment of intelligence and memory. Oppenheim regards this as an exceptional case of genuine epilepsy which terminated in status epilepticus, epileptic coma and finally death.

The last three cases present an unusual phase. In two patients formerly healthy, convulsions were brought on by cold douches to the spine. In the third the inception of the convulsive attacks is attributable to treatment for obesity with the Bergonies apparatus. The attacks followed two weeks after the interruption of a course of thirty-six treatments. The attacks are epileptic and have been recurring every three months for the past four years.

GOTTBRAH, San Francisco.

THE TREATMENT OF CASES OF SHELL SHOCK IN AN ADVANCED NEUROLOGICAL CENTER. WILLIAM BROWN, M.A. M.D., Oxon., D.Sc., London. *Lancet* 2:197 (Aug.), 1918.

Dr. Brown presents the results of a large experience in advanced neurologic centers in France, where he treated some thousands of cases of functional nervous disease, following largely the teachings of Déjerine and Freud. Of

the cases which he saw within forty-eight hours of the breakdown, he was able to return 70 per cent. to duty in two weeks. He feels that his success was due more often to prevention than to cure. Working on the basis of repressions and emotional conflicts he employed modified hypnosis to "bring up" the causes of the neurosis and once presenting them to the patient carefully analyzing them and making him familiar with them. He put the patients into a light sleep and directed them to tell him of the scenes encountered and experiences lived through, then gradually brought them out of the hypnotic state, at the same time connecting the experiences with the daily life as much as possible; in other words, making the repressed emotional reaction appear as ordinary as possible. This mental analysis, thoroughly done at the first hypnosis, was all that was necessary, as a rule. No suggestion other than that of encouragement and assurance that the patient would get entirely well was used. He established a high order of enthusiasm for the recovery of the patient and convinced him by his own convictions. It was very essential to make a thorough and immediate neurologic examination of the patient as soon as received and assure him earnestly that no organic condition existed, thereby removing fears of permanent disablement. Getting the patient well in hand early in the disease he was able to counteract any mechanical suggestion which might take place. The conversions and repressed emotions were "abreacted" before they had become fixed; dissociations were cleared up; the patient had no time to fix his symptoms. During the analysis under light hypnosis the deafness, mutism, blindness, paralysis, or other manifestation of the disease was usually cleared up, and there were no recurrences. This applied to the cases of hysteria, but in the neurasthenic cases he found that mental analysis without hypnosis, and with reeducation were the essential points of attack. In both types of case the usual hygienic measures, physical and psychical, were carried out. Occupation during convalescence was a recognized aid. In the lighter cases of hysteria, reassurance, conviction and confidence in the physician, together with persuasion was all that was needed to effect a cure.

PATTEN, Philadelphia.

THE AUTOMATIC BLADDER, EXCESSIVE SWEATING, AND SOME OTHER REFLEX CONDITIONS IN GROSS INJURIES OF THE SPINAL CORD. HENRY HEAD, M.D., and GEORGE RIDDOCH, M.D., *Brain*, Lond. 40: Parts II and III, 188-263, 1918.

In soldiers with spinal injuries the authors have studied a number of the phenomena observed after total transverse division of the spinal cord and record the results of their investigations. The paper, as is customary in publications which appear in *Brain*, is divided into several "chapters."

Chapter I deals with the automatic bladder. Under favorable conditions, after complete division of the spinal cord, the bladder may begin to expel its contents automatically within 25 days of the injury, while in unfavorable cases—in chronic sepsis due to bed-sores, cystitis or pyelitis—automatic urination may never become established and continued catheterization may be necessary. In all cases in which the lesion is above the lumbar region, if the spinal cord recovers its functions after the first period of shock, it may pass into a condition in which peripheral extravescical stimuli may influence automatic evacuation of the bladder. Thus scratching the sole of the foot, or the thigh or the abdominal wall causes a flexor spasm and the bladder to expel its contents when the latter scarcely amounts to one-half of the amount otherwise necessary to produce a contraction of the muscular wall. After destruction of the

lower lumbar and sacral roots, the bladder may evacuate its contents automatically when a certain distention of the organ has been reached, but this automatic micturition can, of course, no longer be influenced reflexly by afferent impulses. The patients, however, may be conscious of distention of the bladder and may experience the pleasant sensation which normally accompanies its evacuation. A certain amount of distention acts as an adequate stimulus to evacuation, but when the bladder is acting automatically, deep breathing or pressure on the abdominal wall may cause it to expel its contents before they have reached sufficient volume to be otherwise an adequate stimulus. Irritation of any part of the body above the level of the lesion or in an unaffected limb does not influence this automatic bladder activity. When automatic micturition has been established, evacuation of urine is governed by the response to tension of the bladder wall, the relaxation of the tonic sphincter and by the effect of extravesical reflexes.

As a practical deduction, the authors advise that in irrigation of an "automatic" bladder it is most important to avoid undue tension. When it is to be washed out, the volume of fluid at which evacuation occurs should be determined, and the viscus should always be allowed to empty itself, as far as possible, in response to endovesical stimuli.

In Chapter II a description of the phenomena of excessive sweating in gross lesions of the spinal cord is given, and, in accordance with the ideas of Langley and Anderson and of Elliott, the sweating is explained as due to the activity of the involuntary nervous system in the thoraco-lumbar outflow—*below* the level of the lesion.

The extent of area of the sweating differs according to the situation of the cord injury. When the lesion is in the lower cervical region, the head, neck, arms and abdomen may sweat profusely; a lesion of the third thoracic segment may cause perspiration over both arms and the trunk below the second rib; when the injury was at the sixth thoracic level, there was some moisture of the palms of the hands but the hyperidrosis extended from the fifth rib downward; when the ninth thoracic segment was affected, the excessive sweating corresponded almost exactly with the analgesia. In favorable cases, scratching the soles of the feet or any part below the level of the lesion, or distention of the bladder or lower bowel with fluid, often caused very profuse sweating over definite localized areas. If a change in body temperature is due to some general febrile cause, the sweating becomes general.

Chapter III deals with the reflex activity of the spinal cord below the level of the lesion. Under certain conditions the cord below the lesion shows signs of diffuse reflex activity as when scratching the sole of the foot causes flexor spasm, excessive sweating and premature evacuation of the bladder. When these "mass reflexes" are present, the reflexes have, to a great extent, lost their local significance. The "extensor thrust," so-called by Sherrington, cannot be obtained when the spinal cord is completely severed anatomically or even functionally. These extensor reflexes are associated with the maintenance of postural tone and the mechanism on which they depend consists of intraspinal (proprio-spinal) arcs. The control of these movements is situated somewhere in the midbrain and pons and is responsible in man for the appearance of primary extensor manifestations after injury to the spinal cord. Flexor responses, on the other hand, are protective in nature, are the oldest in the phylogenetic scale and belong to the ancient nociceptive mechanism. Their reflex mechanisms reside in the more lowly centers in the nervous system.

The authors believe that so long as local reflex signature is not destroyed and so long as primary postural reflexes can be obtained, the lower end of the spinal cord has not been liberated from control of the parts above the lesion and the overflow of reflex energy into visceral channels will be inhibited.

[The clinical investigations and ingenious methods by which the observations were made, cannot be described here. A careful study of the paper will repay the reader who desires to understand the physiologic principles which underlie the phenomena of automatic bladder activity and other reflex conditions in gross injuries of the spinal cord. And he will find some highly suggestive ideas on the influence of the involuntary nervous system on certain reflex phenomena in the distal end of a severed spinal cord. While the views expressed correspond to the teachings of the Cambridge school of physiologists and to those of Sherrington and Hughlings Jackson, they are at great variance with the ideas of the French—of Babinski and of Marie. The views of Head and Riddoch appeal very strongly to the reviewer.]

ELSBERG, New York.

NEUROSES AMONG RETURNED SOLDIERS, TYPES AND INDICATIONS: CAPT. CLARENCE B. FARRAR, C. A. M. C., Ottawa, Psychiatrist to the Military Hospitals Commission of Canada. Boston M. & S. J. 179:583 (Nov. 7), 1918.

The paper reviews the first few thousand cases of neuroses returned to Canada from France. Among the types of functional disturbances he discusses in particular the neurasthenic states. The neurasthenic presents features of real nervous exhaustion, and affects all classes. This is contrasted with the development of spectacular symptoms of hysterical nature seen in the younger soldier and among those who have been at the front a shorter time. The cases of neurasthenia show a decided tendency to habit fixation and are more difficult of cure. Pre-enlistment causes were found in 30 per cent. of the cases with epilepsy making up 83 per cent. of that number and psychoses 51 per cent. In the classification of the nervous and mental cases returned, the neuroses made up about 50 per cent. of the total; and of all cases returned 12 per cent. were neuropsychiatric.

In dealing with the functional disorders it is found that there are certain stereotyped symptoms common to all. There is a feeling of general weakness, disturbed sleep, headache and other pain reactions, dizziness or faintness, tremors, psychomotor irritability, complaint of dyspnea and palpitation on exertion, vasomotor disturbances, difficulty in fixing attention and of sustained effort of any kind. Of all the symptoms in neuroses the last to disappear as the patient improves are those of purely subjective character.

Of the epileptics many were found to have developed since entry into service, many were admitted in spite of careful examinations at the recruiting stations, and many who returned diagnosed as epileptics were really something else, usually neurotics.

The general characteristics of the neuroses illustrate a preponderance of exogenic factors in causation; a distinctive war coloring; a wide prevalence of neurotic reactions at least in mild or transitory character in soldiers at the front though not necessarily disabling; phases of trench neuroses masking for a time or modifying the course of actual mental disease; association of neuroses with minor physical disabilities; an attitude of hospitality on the part of the patient to his disability which amounts to satisfaction; fixation of symptoms resulting from fixations of underlying motives.

Prophylaxis should be followed out along the following lines: Elimination from the ranks at the very beginning of those apt to break down; institution of proper suggestion among the men showing them the real nature of neuroses since a certain amount of advance knowledge of this kind skilfully disseminated among the ranks and backed up by a wholesome rigidity both in treatment and discipline will go far toward reducing the frequency and persistence of war neuroses.

The paper shows nothing unusual except the low percentage of cases in which predisposing factors are found; this does not accord with recent investigations, and many writers have gone so far as to state that in nearly every case neuropathic predispositions are evident. Laudenheimer states that 90 per cent. of the patients were predisposed before joining the army; Forsythe says 100 per cent.; Mott says 60 per cent.; while Eder coincides with Farrar in 30 per cent.

PATTEN, Philadelphia.

AN ESTIMATION OF THE PROPORTIONS OF GRAY AND WHITE MATTER IN THE HUMAN BRAIN, MADE THROUGH THE PLANE OF THE OPTIC CHIASM BY MEANS OF THE PLANIMETER. A. E. TAFT, M.D., *J. Nerv. & Ment. Dis.*, 47: No. 3, p. 161.

Dr. Taft reports the results of planimetric measurements on one frontal section from each of 157 brains. These are divided into the following groups:

Cases		Cases	
No psychosis	9	Manic-depressive insanity	19
Infants and microcephalics.....	6	Dementia praecox	20
Feeble-minded	18	Senile dementia	12
Epileptic	10	Hemiplegics	5
Criminal (judicial homicides).....	7	Unclassified	1

The method adopted was the determination by means of the planimeter of the proportion between the area of white and the area of gray matter exposed in a single frontal plane as represented in a photograph of the section or in a myelin sheath preparation of a total brain section. It must be acknowledged that a review based on a measurement of a single section of a brain can be considered as scarcely more than a survey and yet the results lend themselves to some interesting conclusions. Autogenetic relations, as the author points out, would lead to the expectation that in the infants' brains and those of certain classes of failure of normal growth—namely, the microcephalics—that the gray matter which precedes the white in its development would be in greater proportion, and this is borne out by the preponderance of gray over white as 55 is to 44. The only other group to approximate this ratio is that of the hemiplegics. This series of five cases is not reviewed in detail, but from the illustrations of three of them and the meagre description they are apparently congenital hemiplegias associated with marked underdevelopment or destructive atrophy of one hemisphere.

The control group of cases of malignant disease without psychoses showed a proportion of 47 for the gray matter to 53 for the white. The manic-depressive group were nearly identical with the normal 46 to 54. The dementia praecox series showed a relative lowering of the gray value—43 to 57—which the author regards as an index to cortical atrophy, and in support of this the proportion of gray in the senile demented where cortical atrophy is to be expected is still lower—as 41 is to 59.

It is generally accepted that a general reduction in brain volume is to be anticipated in the senile period whether or not a frank psychosis is in evidence—a simple senile atrophy comparable to that which affects the other organs of the body. This reduction may, as Donaldson has pointed out, arise through loss in volume of the myelin sheaths and does not necessarily presuppose destruction of functional elements. Of the nineteen cases included in the manic-depressive group, ten are within the senile period—the ages range from 63 to 84—and with one exception within the age limits of the cases forming the senile dementia group—from 64 to 83. A further examination of the data shows that the average ratio of gray to white in these ten cyclothymics of advanced age is, excluding decimals, the same as the ratio of the nine cases under 60 years of age. This offers the suggestion that any atrophy which may have occurred as an involution change in these cases has been of a generalized nature affecting gray and white equally and not a selective cortical process such as that postulated for the presbyophrenics.

On the whole, although conclusions drawn from one section of each brain are hazardous, the results are of interest and suggest that the method may prove of value in determining (1) the relative stage of normal development reached in structurally subnormal brains, and (2) in differentiating between the generalized atrophy of senescence and the more selective cortical or medullary destructions of the same period.

ORTON, Philadelphia.

SUBCONSCIOUS IN ITS RELATION TO THE CONSCIOUS, PRECONSCIOUS AND UNCONSCIOUS. L. E. EMERSON, M.D., Psychoanal. Rev. January, 1919.

In an effort to gain a sharper definition of the concept of the unconscious, a delimitation is suggested by which the subconscious is defined as that part of the unconscious which, once conscious, is capable of being trained, is educable. It is an attempt to reconcile the strictly Freudian concept of a non-educable unconscious, which often offers a nihilistic outlook to therapeutic endeavor, with the frequently observed presentations of dream content in which are defined undoubted evidences of progression, or educability. There is a wider intention, of course, defined in this article toward meeting the facts, with an admittedly different hypothesis.

PARKER, New York.

NEUROSES AND PSYCHOSES OF WAR. WILLIAM ALDREN TURNER, C.B., M.D., Temporary Colonel, A. N. S., and Consulting Neurologist. *Lancet* 2:613 (Nov.), 1918.

This paper discusses the types of reactions as seen under the voluntary system of recruitment in the early days of the war, and the later type as seen under compulsory service. Earlier, "neurasthenic symptoms were not uncommon in association with conflicts in the minds of conscientious men, who were torn between duty to their country and their personal feelings, opinions, and habits." The compulsory service has brought many men into it who were constitutionally unfitted for the work, and due to lack of adaptation have broken down nervously or mentally. The neurasthenic reactions to camp life are identical with those of civil life, military discipline being the potent factor. A certain proportion pass through the period of training without difficulty, and later break down under the hardship of combat service; these are constitutional neurasthenics and about 10 per cent. give a history of previous mental breakdowns. In actual warfare the emotional causes are very

prominent. Confusional psychoses are commonest and often superimposed on a basis of feeble-mindedness; in others, it is the result of physical or psychical trauma. The prognosis in these conditions is relatively good, excluding the confusional states that are the forerunners of dementia praecox and not of long duration. Of the psychotic cases admitted to Lord Derby Hospital, the following classification was made: Manic-depressive, 28 per cent.; mental deficiency, 19 per cent.; delusional insanity, 19 per cent., and dementia praecox, 8 per cent.

The author dwells on the stupors, deliria, and amnesias, stating that the two commonest types of these are torpor and visionary delirium. The stupors are distinctive, there is absolute loss of consciousness in the more severe cases, some catatonic symptoms, deep reflexes normal or exaggerated, pupil reflex impaired or lost, plantar reflexes may be lost, retention of urine at times, but the swallowing reflex is usually maintained. Other cases show a milder grade of stupor and appear as in a daze or dream state, and are found to begin coincident with some psychical shock. The duration of the stupor is often variable and on awakening the patient frequently shows symptoms of functional disorder, as deafness, mutism, tremors, headaches, battle dreams, vertigo, lack of concentration and fatigue. The patient apparently is amnesic for the period of the stupor and sometimes for the antecedent period. The same condition may be found in a pure concussion case, but here the amnesia is more profound, and is of both anterograde and retrograde type. The majority of the cases of stupor are psychoneurotics, and the patient designates his condition as a "loss of consciousness" or "loss of memory."

The clinical types of the war neuroses are: (1) those showing the fear reaction in dilated pupils, staring eyes, tachycardia, sweating, or the type showing rhythmical tremors; (2) those showing features of fatigue and nervous exhaustion, with weariness, jumpiness, irritability, difficulty in concentration, frightful dreams and disturbed sleep, palpitation, giddiness, sense of oppression and anxiety; (3) those showing the symptoms of an anxiety neurosis, loss of sleep and appetite, worry over their duties, lack of confidence, shakiness, emotionalism, disturbed sleep (nightmares), headache, mental depression, fears as to sanity, the climax being produced by some commotional shock, and (4) those showing speech defects, mutism, deaf-mutism, aphonia, stuttering, tremors, tic-like movements, gait disturbances, "bent backs," and other types of hysterical manifestation. These cases are usually admitted in a state of stupor following a shell explosion or burial.

The organic conditions are differentiated from the functional by careful neurologic examination, although in cases of stupor and delirium this may be difficult for a few days. Too much stress has been laid on the physical causes of these conditions and not enough on the psychic. The school of modern psychopathologists maintain that the causes of the psychoneuroses are the failures in adjustment to the unusual conditions, while the French neurologists lay emphasis on "cerebral commotion."

The effect of concussion according to the French neurologist may be direct or indirect. In the former the findings indicate disturbance in the central nervous system by the blood stained spinal fluid, increased pressure, albumin content and a lymphocytosis, in addition to the symptoms of shock, namely, muscle relaxation, hypotonia, impairment or abolition of deep reflexes, extensor plantar reflex, inequality of pupils, impairment of light reflex, retinal hemorrhages and voltaic vertigo. There is an initial period of unconsciousness, followed by a "twilight state." The symptoms of physical trauma may disappear

within a few days and there may then follow a train of psychoneurotic symptoms, apart from the concussion phenomena, or recovery may shortly take place.

The part played by minor direct physical conditions through suggestion is considerable. Farrar states: "The injury of nervous tissue is not necessarily the cause of any possible manifestation which may follow, but it may serve as the starting point of certain trains of association which need never be fully in the consciousness of the patient, but which nevertheless eventuate in the developed fixed neuroses, with all its psychical neurological and somatic phenomena." The chronic symptoms of the traumatic neurosis are persistent and severe headache, photophobia, hyperesthesia to sounds, vertigo associated with labyrinthine hyperesthesia, insomnia and battle dreams, with, on the psychologic side, loss of, or perversion of memory, irritability, loss of self confidence, defective concentration, slowness of thought, over emotivity, terror dreams, anxiety and depression. There is a close resemblance in these symptoms to those of the anxiety neuroses. The course of the traumatic neurosis is usually protracted, and the liability of relapse under similar conditions is much greater. The symptoms are often exaggerated—consciously, perhaps, or unconsciously.

The prodromas of the neuroses are shown, by an analysis of the mental conflicts of the soldier, to be fear, anxiety, a desire to carry on, loyalty to his fellow men, the instinct of self-preservation, which are active over a longer or shorter period of time and brought to a climax by explosion of shells in his vicinity, physical trauma, or some disgusting sight. In these individuals the reaction to discipline and training are not normal. It is stated that the wounded though exposed to the same condition do not develop a neurosis, since they no longer have a motive—their mental conflicts having been relieved by their transfer to the rear; they are disabled and no longer able to participate in dangerous activities. The acute symptoms of the neurosis appear as the patient recovers from his confusion or stupor, and he claims he does not recall the onset, but careful questioning reveals the fact that there was an interval of some duration between the time of the explosion and the loss of consciousness. Sometimes the symptoms of the neurosis do not develop until a considerable interval has elapsed; these patients usually show a confusion during which they do many unaccountable things for which they have no apparent memory. Brown states that this amnesia is merely a splitting of the personality, and that the knowledge of the events following the explosion may be elicited or "brought up" by means of a mild hypnosis. Meyers states that this is a dissociation from inhibition, and that the mutism which developed as the patient emerges from the stupor is a relic of the stupor, and the last of all the symptoms to disappear. The author discusses various hysterical manifestations, laying emphasis on the frequency of astasia-abasia and noting that it may be accompanied by tremor or anxiety, the patient being obsessed by a fear that he cannot walk. The disorder becomes a fixed habit if not treated early, as usually happens in most functional cases. Anxiety and depression symptoms may appear separately, combined, or in association with other disturbances such as terror dreams, tremors and physical reaction. The progress in these cases is estimated by the dream frequency. Fear and dread underlie the symptoms of depression but the depression is not continuous or negativistic as in melancholia. Rest, absolute quiet, sleep, and psycho-therapy are indicated for the relief of these conditions. Of the hysterical manifestations as mutism, astasia-abasia, aphonia, paralysis and contractures, the men are more commonly affected than the officers, but at times a mixture of these and depression or anxiety are found. The officer manifests the anxiety state

in his fears for his adequacy and competence while the private is antagonistic to fighting and wishes only for relief. In discussion of the etiology Dejerine holds to the view that the neuroses are the results of emotional reaction rather than of suggestion as viewed by Babinski. Hysterias are less frequently seen on the line than when the patient has reached the rear and is comfortably situated in some hospital. Trauma acts through autosuggestion and emotion, and contractures may follow slight wounds, or pain from any physical cause may suggest a paralysis or contracture to the invalid and, as in most cases, the war hysteria becomes a defense mechanism.

In the treatment, psychotherapy consisting of suggestion, persuasion and reeducation is effective. Mechanical appliances are worse than useless as they tend to fix the functional disorder. Segregation of the patients in a special hospital is of great benefit as functional disorders are less apt to be copied by the patient than the various suggestions offered by those suffering from physical disabilities. An atmosphere of cure must be the prevailing note and the establishment of early treatment is absolutely essential rendering the task less difficult and diminishing the possibility of fixing of symptoms. In convalescence reeducation and occupation are of great value.

PATTEN, Philadelphia.

THE TREATMENT OF HYSTERIA. JULIAN WOLFSOHN, J. A. M. A.
71:2057 (Dec. 21), 1918.

This article is based on the work done by the author in British and American hospitals and is a summary of his conclusions in the treatment of 573 cases. Of these cases he cured 95 per cent. completely and 90 per cent. within twenty-four hours. He discredits the use of hypnotism, psychanalysis and general anesthesia, believing, in the presence of the existing emergency, that suggestion, persuasion and reeducation accomplish the desired results as speedily and surely. He describes his method of treatment in the individual case, the cure of the manifest symptoms, and gives a general guide for the physician in handling this type of case. He points out the need of a careful initial study of the case from the view point of history and psychologic make-up of the individual, and the arrival at a correct diagnosis before attempting treatment. There must be established a quiet, firm, confident atmosphere of cure, and the early inculcation of the principle that the physician is master of the situation. Treatment must begin early, thus depriving the patient of an opportunity to fix his symptoms or acquire new ones through contact with other patients and suggestion. The more severely afflicted cases do better when isolated. The patient should be approached according to his intellectual level, the more intelligent being more amenable to direct persuasion, and suggestion, coupled with an explanation of his disease, whereas the less intelligent sometimes need a convincing argument in the manner of the electric appliances and mechanical suggestion (prolonged use of any mechanical appliance is contraindicated since it tends more to the fixation of the symptoms). Whenever the patient shows the least improvement or progress, this should be made the basis for an appeal to greater effort and encouragement. The maintenance of strict military discipline together with the evidence of strong will power of the physician is essential. Treatment should be carried out in a room that is free from disturbance or distractions of any sort. New suggestions should be avoided and segregation of these patients from organic cases or other types of disease is necessary. The disease should be made an unprofitable one for the patient and his fears should be allayed as to there being any permanent or organic disablement in his

condition. The physician must needs have patience and never give up on a case until its cure is completely established. The writer concludes by stating that "the most potent causes of failure to cure are ill will of the patient, unfavorable surroundings, and mistakes in diagnosis." A certain amount of follow-up is necessary in each case and occupation is beneficial during the convalescence.

The author's presentation of the outlines for treatment is clear and concise, but it is not believed that much can be done in the way of careful psychologic study of the case when it is so promptly disposed of after admission. It is true that the manifest symptoms can be removed, but the underlying mechanisms only yield to prolonged and careful investigation and treatment.

PATTEN, Philadelphia.

THE EFFORT SYNDROME. ALFRED E. COHN, M.D. (New York), Major, M. C., Senior Consultant in General Medicine, A. E. F., France. J. A. M. A. 71:2132 (Dec. 28), 1918.

The writer opens the paper with a brief consideration of murmurs. The war has not altered the significance attached to diastolic murmurs, either of aortic insufficiency or of mitral stenosis, and persons affected with these two disorders have been uniformly rejected from the service. Opinion has altered as to the significance of other important indications of organic heart disease, notably, as to the determination of important and unimportant systolic murmurs. Experience has shown that certain attendant symptoms are most valuable in this determination, namely, those relating (1) to the size of the heart; (2) to the history of infection, especially rheumatic; (3) to the intensity of the second sound in the second left interspace or third left costochondral junction, and (4) to the reaction to exertion. While not exclusively reliable in determining a diagnosis, when a systolic murmur is present, these criteria are of practical value in case a slight enlargement and history of recent rheumatic attacks are also present.

Of greater importance is the effort syndrome, functional in nature. This is the disorder formerly known as the "irritable heart of the soldier," recognized during the Civil War. The principal symptoms are breathlessness, giddiness, sense of fatigue, pain in the chest, often precordial, palpitation, anxious facies, shakiness of fingers, of extremities, sometimes of the whole trunk, cyanosis, sweating, skin hyperesthesia and hypesthesia, and tachycardia. Complaint and report on sick call may be on the ground of one symptom only. According to Hume, pain in the chest is the dominating subjective complaint in 768 cases out of 1,000, breathlessness in 675, giddiness in 403, palpitation in 354, precordial tenderness in 268, fainting with loss of consciousness in 98, and fainting without loss of consciousness in 25. In addition to the soldier's complaint he is likely to look worried and present tremors or shakings. Questioning will elicit the fact of suffering from headache, bad dreams, furtive pains, and increasing disability to work. When pain is in the chest, it is usually sharp, sticking and fleeting, seldom constricting. Effort tends to bring it on. Associated with the pain, areas of skin hyperesthesia are found in from a quarter to one-half the cases, varying in intensity. Breathlessness, manifested in some reported cases by frequencies of from 60 to 80 a minute, resulting from effort, and returning to normal after rest and prostration on the ground, is common. Propping up, as in the case of heart disease, is not necessary for relief. Cough and spitting are not prominent. Fatigue may alone be sufficient to incapacitate the soldier, a walk of 100 yards or the

carrying of light equipment being beyond his ability. Muscular tone may be low. Occasional attacks of fainting occur. Cardiac palpitation, sometimes persisting through rest, is a common symptom. Tremors are coarse and shaky, and often overshadow the picture. Although the affection does not involve a disordered action of the heart (D. A. H.), irregularities will be found, as they will in any large group in a community, but they are not a factor in the effort syndrome.

Racial predisposition as a factor in etiology has been disproven. Investigation has not shown that it is dependent on any specific infecting organism. Of more importance is the possibility of disturbance of thyroid secretion. Many symptoms are shared in common by exophthalmic goiter and the effort syndrome. But in the effort syndrome exophthalmos is usually absent. In the effort syndrome dyspnea and increase of the size of the heart do not attend tachycardia, as is the case with exophthalmic goiter. Then too, the tachycardia and dyspnea of exophthalmic goiter persist as a rule, while in the effort syndrome they disappear. Many effort syndrome cases have not arisen *de novo* as a result of the war. The stimulus of military exertion has driven latent defects into consciousness. There is a group which have reacted to the stimuli of war by manifestations partly cardiovascular, partly psychoneurotic. It is most interesting that the author finds "the most difficult part of the subject to discuss is its relation to the war psychoneurosis."

The variety of origin of the cases of effort syndrome forbids rigid generalization as to their treatment. As a rule they should not be collected into hospitals. Medicomilitary supervision in camps, with discipline and occupation, is preferable. Physical exercise in drill, farm work, and games is advisable. Attention to the neuropathic elements of their condition should not be overlooked in the therapeutic plan.

REYE, Detroit.

NERVE ENDINGS OF SENSORY TYPE IN THE MUSCULAR COAT OF THE STOMACH AND INTESTINES. PRELIMINARY NOTE.

F. W. CARPENTER, J. Comp. Neurol. 29: No. 5, p. 553.

Carpenter calls attention to the fact that while the literature gives many references to the motor nerve endings in the wall of the alimentary tract and other smooth muscle organs, only one reference is made to nerve endings of a sensory type—that by Ploschko in the wall of the trachea. The work of the physiologists and clinicians indicates that sensory impressions arising in the alimentary tract all have their origin in distention or contraction. There is no evidence of tactile or other special sensitivity in the mucosa and the accepted opinion is that the muscular coats form the site of origin of the afferent stimuli to the myenteric plexuses.

Carpenter reports the finding in the stomach of the cat and the intestine of the dog of fine terminal skeins, nets and tufts which conform to the sensory rather than the motor nerve termini. The examinations were made in material prepared by the *intra vitam* methylene blue method. The skeins and nets are recorded in the stomach of the cat and are found in greatest number in the longitudinal muscle bundles. A few were seen in the subperitoneal connective tissue and an occasional one in the deeper layers of the muscle, but none in the submucosa or mucosa. They terminate fine varicose non-medullated nerve fibers whose course has not been traced. The terminal tufts in the dog's intestine are similarly placed in the longitudinal muscle coat and the fibers from these have been traced to and into the myenteric plexus.

These findings of Carpenter's when confirmed will prove an interesting confirmation of the deductions of the physiologists from their experimental data.

ORTON, Philadelphia.

SHELL SHOCK AMONG TROOPS. MAJOR THOMAS W. SALMON, in the report of recent studies in England. *Boston M. & S. J.* **178:133** (Jan. 24), 1918.

Mental and functional nervous diseases constitute one-seventh of disability discharges from the British Army, or one-third, if discharges from wounds are excluded. Sir John Collie, President of the Special Pension Board on Neurasthenics found that the neuroses constituted 20 per cent. of the disabilities in 10,000 consecutive cases. He recommends that the functional nervous disorder be not considered a pensionable disability, until a year's special treatment had been given the individual, both because of the economic consideration and the injustice of discharging men whose disabilities developed while in service.

In the light of recent studies and facts in therapy there seems at present little need for this view as cases are being rapidly cured of their disabilities at the front and in the cases invalided home cures are taking place promptly. The signing of the armistice has been a powerful therapeutic agency, but even before it definite methods of treatment were meeting large successes.

PATTEN, Philadelphia.

Society Transactions

BOSTON SOCIETY OF PSYCHIATRY AND NEUROLOGY

Regular Meeting, Nov. 21, 1918

CHARLES G. DEWEY, M.D., *President*

THE TREATMENT OF NONPARETIC NEUROSYPHILIS BY INTRA-VENTRICULAR INJECTION. Presented by DR. KARL A. MENNINGER.

DR. MENNINGER informally discussed the above topic, speaking of the great number of hopeless syphilitic hemiplegics seen in the wards of general hospitals. The value of intraventricular therapy in cases of general paresis had led Dr. A. L. Skoog and the speaker to undertake similar therapy in the non-paretic forms of neurosyphilis. Two cases with favorable outcome were cited, and the statistical evidences of improvement given. The conclusions pointed preeminently to a justification for further study of this form of treatment of non-paretic neurosyphilis.

DISCUSSION

DR. P. C. KNAPP believed that the intraventricular method should be more used and with greater prospects of success in the forms of neurosyphilis mentioned than in cases of general paresis. He said that he had not seen a single case of general paresis treated by intraventricular methods which had not been somewhat benefited. And yet, the most brilliant results can be expected in the meningeal and vascular types. He had noticed the features of meningeal irritation described by the speaker, but had not investigated the fluid by another lumbar puncture. Dr. Knapp mentioned a neurosyphilitic hemiplegic who showed very marked improvement after only a few intraventricular treatments. He thought there was less headache after the intraventricular method than after the intraspinal.

DR. F. J. FARNELL asked if the patients who had responded so well to the intraventricular treatment received any previous treatment by intravenous or other methods. He also asked if the speaker had any explanation to offer regarding the reaction of turbidity not infrequently met in the form of treatment used by the reader. It was not infrequent to see marked improvement in hemiplegias due to syphilis by the more usual methods of treatment, making it unnecessary to resort to the more radical procedures.

DIAGNOSTIC PROBLEMS IN PSYCHIATRY. Presented by DR. LAWSON G. LOWREY.

DR. LOWREY emphasized the importance of a complete analysis of the entire patient before a diagnosis should be rendered. Incomplete analysis is a most common cause of error in diagnosis in psychiatric conditions. The tendency of the beginner is to overinterpret and underobserve. Diagnostic synthesis can be made by experienced men if the facts of observation have been accurately set down.

The object of the present communication was to report some statistics on the problem of diagnostic accuracy. Two types of study had been carried out. The first related to the accuracy of so-called snap diagnoses, and the second to the accuracy of the hospital diagnoses as measured by the diagnoses later established in the state hospitals to which the patients had been committed.

In 300 consecutive admissions to the Psychopathic Hospital, a diagnosis of the mental picture was made by the admitting physician, usually a younger member of the staff, and a diagnosis was recorded by the chief medical officer on the visit next morning. These opinions were then checked by the diagnoses made on the fifth day or at staff meeting later. By this measurement, 64 per cent. of the cases were correctly diagnosed by the admitting physician and chief medical officer on the first impressions. In 13 per cent. of the cases in addition, the chief medical officer made the diagnosis later determined by the staff as correct. In an additional 4 per cent. of the admissions, the admitting physician made the correct diagnosis, not agreed with by the chief medical officer. It can be said, therefore, that in 81 per cent. of the cases, a correct diagnosis was made within twenty-four hours of admission to the hospital. In 11 per cent. of the cases, there was disagreement in all three diagnoses, and in 7 per cent. of the cases the diagnoses of the admitting physician and the chief medical officer agreed, but were later found to be wrong.

In every group except epilepsy, the conditions were at first overdiagnosed. The least accuracy was found to be in the manic-depressive group of cases. By groups, the correct snap diagnoses were made in the following: Dementia praecox, 86 per cent.; general paresis, 83 per cent.; manic-depressive, 67 per cent.; feeble-mindedness, 91 per cent.; epilepsy, 100 per cent.; alcoholic psychosis, 82 per cent.; undiagnosed or unclassified agreed in 37 per cent. It is obvious then, that a brief and accurate analysis of the cases allows a correct diagnosis to be made in from 60 to 80 per cent. of the cases.

At the Psychopathic Hospital, where the patients are seldom seen for longer than a month, the diagnosis must be made on the symptom analysis and the history. The diagnoses of 419 cases as established in the state hospitals after observation were compared with those made at the Psychopathic Hospital after the short period of observation. In 23 per cent. of the cases, the state institutions changed the diagnosis made at the Psychopathic Hospital. Using the state hospital diagnoses as criteria of accuracy, the Psychopathic Hospital diagnoses were found to be correct as indicated (by disease groups): Dementia praecox, 85 per cent.; manic-depressive, 70 per cent.; neurosyphilis, 92 per cent.; acute alcoholic, 67 per cent.; chronic alcoholic, 70 per cent.; senile dementia, 78 per cent.; epilepsy, 100 per cent.; arteriosclerotic, 55 per cent.; Korsakow's, 64 per cent.

The question of the error in psychiatric diagnosis at large and in general diagnosis was raised. The only way to settle the question is for each hospital to collect careful statistics of its own patients and of the ultimate condition to which their disease progresses. The value of staff conferences and reconsideration of all cases within a year of their admission to the hospitals would greatly help in the problem of securing definite information in the matter of diagnostic accuracy.

The diagnostic difficulties in individual cases were next discussed by the speaker, using case records to illustrate the features calling for emphasis.

The first case quoted was that of a Jewish girl, aged 25, who, a month before, had been delivered of a normal baby. After delivery, she became restless, sleepless, fearful, and later depressed and deluded. When examined at

the Psychopathic Hospital, she had visual and auditory hallucinations, was deluded and apathetic, mute and resistive. She was finally discharged against advice and returned to the hospital in about three months, this time being talkative, obscene, excited and showed typical maniacal features, with good insight. She recovered from this attack and since has had another, the third being also of a typical maniacal character. The first attack looked like *praecox*, but the rôle of the delivery and the possibility of endogenous toxemia must be considered.

Another group in which error is easy is in those cases showing a *praecox* syndrome and in which, in addition, there seems to be a definite psychogenic factor, leading one to consider strongly the diagnosis of hysteria. The case to illustrate this was a woman, aged 44, who became much disturbed over a murder in her place of employment, her particular interest in the case arising from the great resemblance of the man accused of the crime to her dead brother. One day she was found much excited and trying to escape from the devil. When examined, she showed paralysis, was hallucinated and deluded, she was manneristic and inaccessible. Careful probing elicited a "spiritual" love affair with the superintendent of one of the state institutions, he having no knowledge of her attitude toward him, with the sexual features predominating. A great emotional complex arose and from it could be reasoned a psychogenic cause for the presenting picture. The possibility of the various paranoid conditions was discussed and the occasional close relationship of these conditions to manic-depressive psychosis was emphasized. A case was cited of a man, aged 45, prominent in his profession, whose presenting features were marked ideas of reference and who later showed typical features of manic-depressive psychosis. The diagnosis in such cases depends on the history and the character of the patient's restlessness and activity.

Another group of cases calling for careful differentiation is that of the neurosyphilitics with psychoses of a type not usually associated with syphilis. Dr. Lowrey quoted a case of a woman with *praecox* features, a chronic alcoholic and prostitute, who was a drug addict and had neurosyphilis. She was treated for the last named condition, though she never has shown any clinical features indicating neurosyphilis.

It seems obvious from these statistics and case reports that accuracy of diagnosis depends on careful and complete analysis of all the symptoms and a probing for symptoms not at once apparent. Only in this way can errors due to false impressions be ruled out. Another important lesson is the importance of uniform diagnostic standards. Then, even if the idea is wrong, workers in the same field will at least be on common ground. Many psychiatric terms are unnecessarily vague and should be replaced by less indefinite ones. The more accurately observations are made and the more accurately they are recorded, rather than deductions, the sooner will uniform standards be adopted, and a vast amount of clinical material be made available for general study.

DISCUSSION

DR. P. C. KNAPP asked the speaker by what criterion he decided that a given diagnosis was correct or not. He said that in some of the cases, necropsy or laboratory findings might establish the diagnosis, but in many cases these could not become available. Authorities still disagree as to the existence of some of the conditions as diagnosed and many of Kraepelin's ideas are being replaced. So it would be interesting to know how a diagnosis was arrived at.

DR. E. H. COHOON said that he had been fortunate in having had state hospital experience before going to the Psychopathic Hospital and his present associations had led him to appreciate the difficulties of making diagnoses at the Psychopathic Hospital where the patients are seen for such short periods. He felt that the staff at the Psychopathic Hospital were very good indeed to be able to do as well as they do. He asked if the statistics were made up with the alternatives in diagnosis considered.

DR. J. V. MAY thought that it was remarkable that the Psychopathic Hospital diagnoses were correct in such a high percentage of cases. He spoke of the difficulties encountered in the hospital in the way of student help and an ever-changing staff. He asked how the series as presented had been prepared and suggested that it would be of value to collect the end-results and diagnoses on a larger number of cases, possibly including all consecutive admissions for a period of a year.

DR. LOWREY, in closing the discussion, said that when the Psychopathic Hospital sent diagnoses to the state hospitals, only one diagnosis was given—sometimes unclassified—and the alternatives were not used. He mentioned the difficulty of being sure what was or was not the correct diagnosis in any given case, but the standards which had been adopted in collecting the statistics were the most dependable obtainable. He said that the plan of withdrawing cases of neurosyphilis from other mental groupings on the finding of syphilis of the nervous system was not completely followed and that the cases were put in the neurosyphilis group with the added diagnosis of type. He also said that it was evidently true that cases of epilepsy were being missed for it could not be expected that the diagnoses could be correctly made in 100 per cent. of those cases. The possibility of making direct commitments instead of keeping patients for ten days, since the diagnoses could be made in a majority of the cases at once, is not practical because of the danger of missing the diagnosis in individual cases.

BOSTON SOCIETY OF PSYCHIATRY AND NEUROLOGY

Regular Meeting, Dec. 19, 1918

CHARLES G. DEWEY, M.D.; *President*

A CASE OF CYSTICERCUS RACEMOSUS (TAENIA SOLIUM) OF THE SPINAL CORD. OPERATION, SURGICAL RECOVERY AND DEATH. Presented by DR. P. C. KNAPP.

The patient had been on the nerve service at the Boston City Hospital and later operated on by Dr. A. R. Kimpton. The case seemed worthy of report because tumors of this character in the spinal cord are distinctly unusual.

History.—The patient was a Russian, aged 25, who, since childhood, had had momentary periods of unconsciousness and dizzy spells, with occasional convulsions in which he bit the tongue. There had been headache and aura. Of late years, he has had three or four attacks a year. A year ago, he had had an attack, without losing consciousness, after which he had a dead sensation of his right arm and leg and marked headache. In the winter of 1916, he had severe pain in both sides of the chest and several attacks of it since. In October, 1917, intermittent pain and dyspnea developed and his legs felt numb. Three weeks before entrance to the hospital, there was severe pain

in the abdomen, high up on the left side. Ataxia and pains in the legs were noted.

Examination.—When examined, the neck was not stiff, the reflexes were exaggerated, there was double clonus and double Babinski, the abdominal and cremasteric reflexes were absent, and there was ataxia and astasia. The Wassermann test was negative; pupils normal. There was hypalgesia and sensory changes below the area of the fourth and fifth dorsal segments, and over the corresponding vertebrae there was distinct tenderness.

Operation.—The patient was operated on March 5; a laminectomy of the fifth dorsal vertebra was done. The spinal fluid was under tension and at the level of the fifth vertebra, an irregular, translucent, cystic mass measuring 5.5 by 1 cm. was discovered. It was enucleated and, at pathologic examination, found to be a cyst containing the *Taenia solium*. The patient did poorly for a time and developed a paraplegia with neurological signs much as previously noted. An extensive decubitus developed together with paralysis of the bladder. He returned home in June, against advice, and died in August.

DISCUSSION

Dr. A. R. KIMPTON said that the operation was decidedly difficult. The anemic area which was found in the cord and which looked but little abnormal was distinctly hard and cystic to his touch. Incision of the cord permitted the mass to be popped out without difficulty, when it was found to be a multilocular cyst. Dr. Kimpton showed some photomicrographs of the sections. He said that so far as he knew, his was the only case of its kind in which the tumor was removed during life. Cases have been reported in which the *Cysticercus* has been found at postmortem examination.

PROTHYMIA: NOTE ON THE MORALE-CONCEPT IN XENOPHON'S CYROPEDEIA. Presented by DR. E. E. SOUTHARD.

In a short communication Dr. Southard called attention to the material in Xenophon's *Cyropedia* as forming material of great value in a historical study of the morale-concept and one which might enliven the ethics of the day. The itemizing of morale-measures in the *Cyropedia* indicates the probable success of a behavioristic version of a large part of morale as the Greeks saw it.

In particular, the roots of most of the words employed in Xenophon's morale-description are roots having to do with movement and speed (rather than with mere strength) and having little to do with mere feelings. Many of the words indicate the thoracic seat of the emotions engaged rather than a seat in the head or in the muscular system at large. Xenophon's description is more a matter of heart than of brawn or of head, but "heart" gets a behavioristic accounting rather than one in terms of felt emotion.

The morale of Xenophon's account in the *Cyropedia* is plainly far from the story of morale in the modern sense, especially the morale developments in armies and nations subsequent to the French Revolution.

The term *prothymia* is indicated for the morale situation as depicted by Xenophon and has several advantages. It is a leading term in Xenophon's list. The root word has hints of motion in it, as well as general usage in compounds suggesting "heart" in a figurative sense; the prefix—*pro*—has suitable intimations of pushing forward in space. Modern psychiatry has come to use the term—*thymia*—in many compounds describing variants of emotion,

such as hyperthymia, parathymia, etc. The term prothymia is euphonious and readily suggests variants and readily lends itself to use as an adjective or a substantive.

THE MILITANT. Presented by DR. EDWARD B. LANE.

Dr. Lane gave the paper of the evening on this subject. He said that alienists are quite frequently asked their opinion about such individuals and what can be done with them. These cases present distinct problems and it is not an easy matter to make the diagnosis and advise appropriate treatment. The reader said that several cases had been referred to him and that an efficient remedy was very difficult to find, if it could be found at all. He had ventured to bring the problem before the Society with the desire for an exchange of opinions.

The typical case, usually a woman, presents a history of having been very efficient and capable when young, perhaps difficult to get along with and regarded by her friends and family as temperamental. Often, she has been a business woman or a teacher. If she has married and has children, she has had little difficulty until along about 40 when the children have reached an age of more or less independence, when trouble begins. The children, especially the daughters, find that they are not permitted to do as other children and appeal to the father who may well sympathize with the children. The mother sees her authority questioned and becomes at once disturbed. Being aggressive, she sets out to maintain the authority. Petty faults and nagging tactics are employed until the entire family becomes arrayed against her. Friends desert the children who cannot bring them home because of the attitude of the mother.

Servants are kept with difficulty for they will not endure living in such an atmosphere or remain under the authority of the housewife. Such a woman may well hold social offices and be tolerated for her administrative ability or social charm. But real friends drop away for one reason or another, invitations to social affairs grow fewer, social calls are not returned, ugly rumors about her family relations are heard and friends dislike to be seen in her company. Petty jealousies and frictions arise and the husband and wife become less cordial to each other. The daughter finds life miserable, for she can do nothing without meeting criticism and opposition from her mother, who feels that she has not been fully consulted about the plans and activities of the child. If the daughter has been receiving attention from some worthy young man, the mother can still find nothing good in him and attempts to villify the young man's character and even goes so far in some instances as to raise questions as to the daughter's virtue. Such tactics lead the father and family to more openly defend the daughter, whereupon the mother attacks the others with equally vile or even worse accusations and insinuations. She may even go so far as to spread suspicion among the business associates and friends of the husband.

Soon she is brought to the physician and before him she is a fine actress. She denies that she mistrusts the husband and that she has made any of the statements for which she has been given credit. She maintains that she has made no insinuations about the daughter and her friends and enters into a long and detailed defense of her desire to do the best for her children. There is usually little or no documentary evidence. She challenges the physician to continue the examinations, hinting that after he has found her sane that she would like to have the husband examined for his actions need explain-

ing. Private detectives may be employed by the wife to secure evidence, though usually the wife is unwilling to divulge any evidence. A lawyer may also have been employed in anticipation of future legal difficulties. The daughter continues to have an unhappy time, in part because of the jealousy on the part of the mother.

Finally, the husband has her sent to some institution for observation. There, the physicians probably find nothing of special note and the conduct of the woman has been without comment, there is no depression or elation, no impulsivities or other features signifying mental disease. The picture she paints of herself to the staff is that of the abused, misunderstood and unappreciated wife and mother. Nothing can be done and she is ultimately released, triumphant.

More and worse trouble is in store for the family. She never stops to inquire if she may not be entirely or largely to blame for the entire situation, but instead, her militancy becomes more aggressive. She consults a lawyer and threatens to sue the physician who suggested the possibility of insanity. She makes many more and far reaching accusations against others. The children either run away from home or resort to means of being there as little as possible. If they do run away, the mother is likely to follow them, especially if the daughter leaves, and all manner of complications arise in the new surroundings. The daughter is haunted from place to place and the insinuations of the mother ruin the girl's reputation. The cunningness and brutality of the tricks played by such a mother may be indeed remarkable. The entire business relationships of the husband may be undermined and his bankruptcy brought about by the methods she employs in her attacks on the husband.

These cases, which need not be further elaborated, bear resemblance to the paranoid states in many respects. But it is difficult to establish any insane delusions. Some of the acts suggest the presence of delusions and true delusions may be expected after years of this state of mind. They are not psychasthenics with obsessional fears, for they do not show fear, they are aggressive. They love the sense of power and become excited and belligerent if it is denied them. They are not imbeciles, their judgment is not impaired except in one field. Like paranoiacs, they add to the list of their opponents all who side with their enemies. The brutality and extremes to which some of these people may go reminds one of the crimes of Jesse Pomeroy and the Huns in Belgium. These people are allied to those who have uncontrollable impulses. The feeling of power destroys affection and overcomes judgment. This same motive stimulates their inventiveness and summons all their resourcefulness to gain gratification of their abnormal appetite. They really belong in the group of the litigant and querulent, in that the age incidence is similar and treatment as hopeless. If they live, mental deterioration may be expected. Actual restraint seems the only logical manner of controlling them.

If legislation is needed for such cases, it will first be necessary for psychiatrists to recognize the condition. Laymen acquainted with the persons concerned recognize that the individual is abnormal and should not be considered criminal. These people are not really deluded, it is on this point that alienists have failed to convince the courts. After all, the truest test of mental disorder is the conduct of the individual in question, by which criterion the militant is assuredly insane. These individuals should not be dismissed as conscious evil-doers, and the family and friends of such an individual fully

realize that they are not responsible. Punishment, if resorted to, merely aggravates the militant and makes matters worse. And no end of criticism is heard from those acquainted even remotely with the situation. If commitment as insane is resorted to, such a person is a most uncomfortable individual in an institution and an early attempt to get rid of the patient is made.

These people act insanely, they lack insight and are without repentance. They are not demented and they cannot be forced into the group of paranoiacs. Their lives are not delusions; hallucinations and confusional states cannot be invented for them. They should be recognized by alienists as a type, and then we should not be obliged to look for the more usual symptoms of insanity, such as delusions. Then alienists could go before a court and present the case as one of a patient who acts insanely, who is irresponsible on the ground of an uncontrollable impulse, and ask for commitment on that ground. No further legislation is needed to cover such a case. The reliance in these cases which must be placed on the history was emphasized and attention directed to the need of special care in that feature.

DISCUSSION

DR. H. B. HOWARD said that he had seen several cases like the type case which Dr. Lane had discussed and spoke of a man whom he had observed over a period of ten years. During that entire period, he had known of but a single delusional idea being expressed. In this instance, the militancy and jealousy were directed toward the son who was a better business man. The father resorted to all manner of accusations and insinuations against his son and finally undermined the confidence of all the son's business associates, bringing failure to him. There had never been any delusions except a single rather trivial one about being afraid to sleep in a certain room because the angle of the roof was such that it might fall on him.

DR. E. E. SOUTHARD wondered whether Dr. Lane's so-called militant group was intended to be limited as to sex and civil condition. He also wondered whether deterioration was to be regarded as a constant characteristic of such cases, which were perhaps more parabolic than paraphrenic. It was exactly in these cases of parabulia that the judge was hard to convince in the matter of committability. Was there not possibly a relation between these cases and a sort of mild sadism?

DR. G. A. BLUMER said that, in his experience, the condition was not as rare as might be supposed and that he too thought that most of the patients eventually deteriorate. He spoke of a man whom he had known a long time, a man holding a very responsible position and discharging his obligations without flaw, who had for thirty years been harboring a secret suspicion against his wife. Not until a recent trip to Europe had the fact been known, for then the husband had interviewed the various men on board ship as to the conduct and behavior of his wife. He even insisted on having a medical examination of his wife on her return. The man has since developed definite delusions and is at present confined as insane.

DR. LANE closed the discussion by saying that not all of the cases which he had known had been among women or the married. An understanding of the unreasonable and entirely incomprehensible actions of some of these people is impossible. When they are sent to institutions, the staff of the hospital hedges and little satisfaction or relief can be given the afflicted person or family. They are a terrible nuisance, though not common. He said that there was no hesitancy in committing cases of kleptomania and pyromania, and he thought that this group should be committable.

CHICAGO NEUROLOGICAL SOCIETY

Regular monthly meeting, held jointly with the West Side Branch of the Chicago Medical Society, Dec. 19, 1918

Clinical Meeting

HERMAN CAMPBELL STEVENS, M.D., *Vice-President, presided*

LESION OF BRACHIAL PLEXUS. Presented by DR. S. KRUMHOLZ.

The patient was a laborer, aged 21. His previous history was negative; no alcoholism or syphilis. On July 1, 1918, he fell from a scaffold 50 feet high. He was unconscious for five hours. On regaining his senses he was found to have a number of contusions and paralysis of the right arm which has persisted. Patient complains of constant pain over the thumb and index finger.

On examination the patient presents complete flaccid paralysis and wasting of the right arm, with the exception of slight motion in the fingers. The scapulae were on an even line; no displacement of the inferior angle, no winged appearance of the back on the affected side, showing that the serratus magnus was not paralyzed. The triceps and biceps reflexes were absent; sensory disturbance present over the entire radial side of the arm, forearm and hand, and radial side of index finger. The cranial nerves were normal; there were no ocular changes, that is, no pseudoptosis, no contraction of the pupil on the affected side, no narrowing of the palpebral fissure, no anophthalmos.

LESION OF BRACHIAL PLEXUS. Presented by DR. S. KRUMHOLZ.

The patient was a laborer, aged 34. Previous history negative. On July 13, 1918, he fell from a racing car, while standing on the running board. He regained consciousness after nine hours and found the left arm paralyzed, which still continues; four weeks after the injury neuralgic pains appeared in the arm.

Examination: No motion in the forearm or wrist; abducts arms not quite to a right angle; shrugs shoulders quite well; arm atrophied; no sign of serratus magnus paralysis; all deep reflexes of left arm are absent; normal in other extremities; anesthesia of the entire arm, except an area extending over the inner border of the upper two thirds of the upper arm; cranial nerves normal; Horner's syndrome absent.

In traumatic, as in other nerve lesions, the chief difficulty rests not in the detection of the lesion, but in the determination of its seat. For the purpose of localizing the lesion the speaker favored Frazier's method, of dividing the plexus into three portions: (1) the intravertebral portion, which contains the separate anterior and posterior roots within the dura; (2) the intervertebral portion, where the roots leave the spinal canal enclosed in a separate sheath of dura and the spinal ganglia lie in the intervertebral foramina; and (3) the extravertebral portion comprising that portion of the nerves from the intervertebral foramina to a point where they unite to form the various nerve trunks. In extravertebral lesions, the symptoms will depend on whether the nerves are injured distal or proximal to the point at which branches are given off to the serratus magnus and rhomboideus, or still lower down to the supraspinatus or infraspinatus muscles.

In these two cases none of these muscles were affected; there was no displacement of the inferior angle of the scapula, and no so-called "winged"

appearance of the back; likewise the ocular symptoms shown by Horner's syndrome were absent. Therefore, we must conclude that we are dealing here with extravertebral lesions of the brachial plexus.

In the treatment of these cases, surgical interference is indicated, when there is no diminution of the paralysis at the end of three or four months, and in the opinion of the speaker the operation ought to be performed immediately after the injury, followed by massage, etc. The operation should be an end-to-end anastomosis of the nerve or an aut fascial tubulization.

In Case 2, about four weeks after the injury, the patient had intense, intermittent, darting, neuralgic pains, which, according to Frazier, can be relieved by section of the posterior roots.

DISCUSSION

DR. GEORGE W. HALL brought out an interesting and unusual finding in Case 1, showing that the affected shoulder was higher than the unaffected, although the trapezius was not involved.

DR. SIDNEY D. WILGUS asked whether the anesthesia could be explained on the ground that the posterior roots were damaged, the motor disturbance being due to injury of the trunk.

DR. H. C. STEVENS asked whether fibrillary contraction of the muscles was observed during the course of the atrophy.

DR. H. J. SMITH asked what the findings were at operation.

DR. KRUMHOLZ, in closing the discussion, stated that in Case 1 the surgeon's record shows that a lesion was found in the lower part of the brachial plexus, one-half to one inch above the upper border of the clavicle, the distal portion being connected with the proximal cord by fibrous tissue embedded in the scalenus anticus muscle. The distal nerve was located readily, the proximal with difficulty. The cords were not severed, but the connections were left after removal of the scar tissue.

In Case 2, the surgeon's record shows degeneration of the nerve trunk and scar tissue. This scar tissue was removed, which was all that could be done at the time.

It is possible that the posterior roots in Case 2 were torn with an intradural lesion of the fifth and sixth cervical and also a lesion of the trunk. An exploration of the plexus and a laminectomy are advisable. Such an exploration might reveal reparable nerve bands, while the laminectomy would reveal such an injury, and the section of the posterior roots might stop the neuralgic pains.

PROBABLE CEREBELLAR TUMOR. Presented by DR. GEORGE W. HALL.

The patient was a laborer, aged 30, who denied venereal disease. He complained of dizziness, disturbed vision, marked weakness of the lower extremities and disturbance in speech, which symptoms appeared in August, 1918. At about 5 p. m., when coming home from work, he had noticed impairment of vision which lasted for a few moments. Half an hour later there was a similar attack, and vision had been impaired constantly since that time. Two weeks prior to this he had complained of severe headache but could not remember the exact location. The headache was accompanied by dizziness, and this had been persistent since the impairment of vision. On account of weakness and dizziness he could not walk and was so weak he could not hold a spoon.

Examination revealed marked bilateral coarse nystagmus, more marked toward the right. Vision, right eye, 6/200; left, 5/200. The disks were slightly

pale; no evidence of choked disk. There was also slight disturbance in speech; syllables were not sounded very well. The reflexes were very brisk in both upper and lower extremities. No sensory disturbance, no Babinski, no ankle clonus. He could touch the nose with the left forefinger fairly well, but there was some evidence of ataxia in the right upper extremity. Ataxia of the lower extremities was more pronounced—right was worse than left. There was no disturbance of the muscle-sense as found in ataxia of spinal origin. No bladder disorder. He complained of external objects going to the left; although his body did not appear to deviate.

These findings, together with the reeling gait, made possible a diagnosis of a lesion in the cerebellum perhaps extending a little more to the right than to the left of the vermis. He had a tendency to fall backward rather than sideways so the lesion was probably in the vermis of the cerebellum rather than in the left lobe. In wrist movements there was better power over the left than over the right. The sudden onset was difficult to explain, but possibly a growth of a gliomatous nature could give this sudden onset on account of a hemorrhage around the growth. Such patients often have slight attacks of paralysis which clear up, and subsequent necropsy shows evidence of hemorrhage. The chief point which spoke against its being a tumor of the cerebellum was the absence of choked disk, but this sometimes occurred. The Wassermann reaction was negative both on the blood and spinal fluid. The fluid showed from 15 to 20 cells with a slight Ross-Jones reaction. The intraspinal pressure was normal. No Abderhalden test had been made. Gordon and Oppenheim reflexes were absent.

DR. PETER BASOE asked if it was possible that the poor vision and pale disks might be due to secondary atrophy, and whether the outlines were perfectly clear? It might mean that he had had an optic neuritis, not very severe, and that suggested that there might have been a time when pressure was much higher than now. They might be dealing with a tumor of the fourth ventricle rather than of the cerebellum proper. Many such tumors gave cerebellar symptoms. It was characteristic of these growths that they may cause sudden pressure symptoms; a sudden hydrocephalus might account for the sudden onset. Such a tumor might exist for a long time without symptoms. Another thing in favor of this diagnosis was the increase of cells and globulin, which is commonly observed in ventricular tumors and more frequent than in pure cerebellar tumors. If it was a ventricle tumor one might expect increase of headache and dizziness in changing the position of the head. This was sometimes true of cerebellar tumors, but was more constant with ventricular growths.

DR. HALL replied that the Bárány test showed nystagmus lasting about twenty-two seconds on each side. The chief things which attracted him were the unilateral character of the symptoms, more marked on the right than on the left. Another thing which was quite characteristic of cerebellar lesions was the ataxia which was so much more marked in the lower than in the upper extremities.

TRANSVERSE MYELITIS SHOWING BEEVOR'S SIGN. Presented by
DR. GEORGE W. HALL.

This patient was a man who had a syphilitic transverse myelitis in the twelfth dorsal region showing a beautiful Beavor sign. (Demonstrated marked movement of the umbilicus upward by having patient raise his head from the pillow.)

PROGRESSIVE MUSCULAR ATROPHY. Presented by DR. GEORGE W. HALL.

The patient was a teamster. There was no history of syphilitic infection. Marked fibrillary twitches were present in the muscles of the back and upper extremities; no sensory disturbances. The onset was gradual, beginning in the right arm and then extending into the left arm. There was marked weakness as well as atrophy of the muscles of the shoulder group and atrophy of the muscles of both hands, a little more marked in the right. There was no Babinski reflex, and no stiffness or spasticity of any kind in the lower extremities.

With the gradual onset in one arm gradually extending to the other a diagnosis of progressive central muscular atrophy had been made.

AMYOTROPHIC LATERAL SCLEROSIS. Presented by DR. GEORGE W. HALL.

This patient was a man with marked spasticity. There was no history of syphilis. There was marked atrophy of the muscles and fibrillary twitches in the upper extremities. The upper extremities were much the same as in Case 3, but the marked spasticity in the lower extremities showed involvement of the lateral column of the cord in addition to the anterior cells. The symptoms had existed for one and one-half years and the two cases could be classified as the same disease. Amyotrophic lateral sclerosis and progressive muscular atrophy were different types of the same disease, and if one of the cases was possibly a multiple sclerosis it was certainly of the amyotrophic type. The Babinski sign was very pronounced, but the spasticity was so great it was difficult to demonstrate it. Oppenheim's sign was not present and there were no sensory disturbances.

SYRINGOMYELIA. Presented by DR. GEORGE W. HALL.

The patient was a man who presented atrophy of the tongue which was seen much better when the tongue was held back in the mouth. Fibrillary twitches were present and marked on the right side only. The patient also showed evidences of sensory disturbance, the pain sense being much less marked on the left than on the right side. The disturbance extended upward to some extent and involved the region of the fifth nerve on the opposite side from the atrophy. The same area showed complete loss of temperature sense. As there was the disturbance in sensation in addition to the findings in the other cases, a diagnosis of syringomyelia had been made. No trophic disturbances were present as yet.

These three cases were presented to show the forms of atrophy that might occur and the differences between them. In Case 4 there was a pyramidal tract involvement, while in Case 5 the involvement was more centrally located, involving the pain and temperature fibers as they crossed over to the opposite side. There was a thickening of the vocal cords which accounted for the change in voice; there was no paralysis, the cords moving normally.

Such cases were not very amenable to treatment. If it was decided that the lesions were of toxic origin, as often happened in organic changes in

the spinal cord, efforts would be made to remove the infection and prevent additional trouble. The destruction that had already occurred, of course, could not be overcome.

DISCUSSION

DR. PETER BASSOE asked regarding roentgen-ray treatment, stating that in syringomyelia they were dealing with an overgrowth of glia and gliomatous growth with caries formation, and it was known that the roentgen ray had an effect in inhibiting the growth of many kinds of tissues—such as on lymph glands and in proliferative changes in the skin—and it seemed reasonable to suppose that if the roentgen ray could be brought into use it might have an effect in checking the symptoms. No destroyed fibers could be restored but it might diminish the growth of the glia. This treatment had been used, especially in France, for about ten years and there had been quite favorable reports. The speaker has used it in a few cases of syringomyelia and other cases of tumors affecting the spinal cord and thought it exerted some influence. He thought it was worth trying, particularly because of the futility of the other known methods of treatment.

DR. HALL stated that syphilis could produce symptoms exactly like these, but this disease was not present in these cases. He felt that multiple sclerosis as well as changes of this character in the central nervous system could be produced by some focal infection. He felt sure that clinically he had seen cases that could be traced back to the teeth, tonsils, or sinuses as the origin of changes in the spinal cord. Some cases of muscular atrophy where there was no positive history of syphilis were nevertheless proved to be due to that disease. The Wassermann test could not always be depended on in cases of tumor of the cord or brain. A positive Wassermann reaction was sometimes obtained on the blood when syphilis was not present, while on the other hand, cases of tabes sometimes gave negative Wassermann findings.

DR. A. W. ROGERS asked what the prognosis was in the case of transverse myelitis.

DR. HALL replied that he did not consider it good. He had been under very thorough treatment for several weeks without any improvement.

DR. PETER BASSOE stated that the man had received treatment for syphilis before there was any nerve involvement at all. The total paralysis developed within ten to fifteen minutes while the patient was in the Presbyterian Hospital being treated for a burn.

DR. H. C. STEVENS suggested that the cause of the atrophy of the tongue was the incessant action of the fibrillary contraction of the muscle fibers. The contractions continue throughout the whole period of atrophy and disappear with the regeneration of the nerve. The contractions occur not only in central lesions but in peripheral nerve lesions as well. There was not much justification for the theory of a trophic influence of the nerve on the muscle. In attempting to find a treatment for muscular atrophy it had occurred to him, following some experimental work, to attempt the injection of calcium, barium and magnesium salts. This was done on guinea-pigs after section of the sciatic nerve. Certain of the operated animals were treated with subcutaneous injections of salts known to have a sedative effect on muscular activity. Other operated animals were used as controls. The weights of the gastrocnemius muscles in the treated and nontreated animals were compared to determine whether the salts injected retarded the rate of muscular atrophy.

CHICAGO NEUROLOGICAL SOCIETY

Joint Meeting with Chicago Medical Society, Jan. 22, 1919

HERMAN CAMPBELL STEVENS, *Vice-President, presided*

WAR NEUROSES. Presented by Dr. HUGH T. PATRICK.

Dr. Patrick said that the neuroses of the war just finished differed from those of peace times not fundamentally but principally only by the tremendous number and the high proportion of severe cases and of anxiety states. The term "shell shock" was first used as a convenient blanket to cover ignorance and a multitude of sins. Now it is an unfortunate term because it implies something new, portentous and not understood.

A convenient way to approach the subject of war neuroses is as the soldier approaches the disorder—by degrees. Some of us cannot comfortably adjust ourselves to the perplexities of civil life. In other words, an unusual trial is too much for us, we "go to pieces," develop a psychoneurosis. Some of our soldiers are barely equal to the adjustment of civil life and the added difficulties and apprehensions connected with mobilization and camp existence are too much for them. They cannot abolish the war, they cannot leave the camp; their only refuge is a neurosis. More stable individuals go through the home training and even the training just behind the lines without difficulty but the inordinate strains, mental and physical, of life at the very front make the situation insupportable. The soldier's deep laid instinct is to fly, hut honor, ideals and military machinery make this impossible. Occasionally a man escapes by self mutilation, occasionally by suicide. Others, unwilling to avail themselves of these means, develop a neurosis which is merely a psychological dug-out into which he creeps for safety. But he does not deliberately do it; he is not a malingerer. He is merely a sentient human being whose instincts are too much for his ideals, intellect and stability.

SOME LESSONS IN PSYCHIATRY TAUGHT BY THE WAR. Presented by Dr. H. DOUGLAS SINGER.

1. *The Size and Importance of the Problem of Mental Health.*—Discharges from the Army for mental or nervous disability were made in 1.6 per cent. of men accepted by the exemption boards. These were three and one-half times as many as for tuberculosis. The failure to exempt by the boards may have been due in part to the instructions given to the draft boards but was also due to lack of training in psychiatry on the part of physicians. This lack of trained psychiatrists was also emphasized by the difficulties experienced by the Army in securing them. Just as in Army life, so in the civil community, mental and nervous disability are most potent factors in social inefficiency, and there is the same need for physicians with psychiatric training.

2. *Types of Breakdown in the Army.*—The striking fact has been a great increase in psychoneuroses without corresponding increase, and possibly even a diminution, in the frank insanities. No new types have been observed in either form. These facts suggest that even a comparatively well constituted man may develop a neurosis but not an insanity, although they might be explained by the elimination of those of poorer construction at an early stage. They also emphasize the importance of environmental factors in determining a mental breakdown. It must further be remembered that we have no statistics concerning the frequency of psychoneuroses in civil life.

3. *The Effect of War Conditions on the Civilian Population.*—In England the commitments for insanity have steadily decreased, there being 3,278 fewer in 1915 than in 1914, and 3,159 fewer in 1916 than in 1915. This cannot be explained by assuming that the diminution in the civil community was due to army enlistment of those who would otherwise have been committed, for the number of insane in military hospitals on Jan. 1, 1917, was only 2,000, and of these only a proportion would need commitment. In Russia, on the other hand, where the organization for the care of the insane before the war was very defective, the number of commitments has increased. In New York the commitments during the forty-four months following the beginning of the war were 3,995 more than in the forty-four months preceding the war.

The English figures suggest very strongly that better social organization, improvement in conditions of employment and recreation with possibly the closer regulation of alcohol are important factors in preventing insanity. It is also noteworthy that crime has diminished very markedly, although for a time juvenile delinquency increased owing to lack of proper supervision and control.

4. *Effects of Treatment.*—Prognosis even in such disorders as dementia praecox has been decidedly better than in peace times. At the Renfrew district asylum in England for military cases, among 500 patients discharged 39 per cent. are reported fully recovered (31 per cent. returned to duty), while only 27 per cent. were committed to a civil asylum.

These figures suggest that prompt recognition with immediate and adequate treatment are highly important even though it is true that the conditions under which the breakdown occurred were very severe and not liable to be met in civil life. They also again emphasize the importance of environmental factors in determining the breakdown. They should teach us the immense importance of first-aid stations or hospitals with adequate facilities for treatment in every community.

REPORT OF NEUROSES IN SOLDIERS, WITH PRESENTATION OF CASES. Presented by DR. PETER BASSOE.

CASE 1.—A private soldier, aged 27, was stunned by a shell explosion on the battlefield in France in March, 1918. He remembered nothing for five days, and then found himself unable to move the left arm and leg or to use the left eye and ear. The whole left side was devoid of sensation. There was a superficial wound of the left leg but none elsewhere. By June he could move the leg well and the arm a little. When he returned to this country in August, he walked well and could raise the left arm to the horizontal, but the grip was so weak that he could not hold anything in the hand. In September, while he was in bed at an eastern camp, a gas stove exploded with a loud noise about 50 feet away from him. He was not injured, but became very nervous, shook all over, was not unconscious. Since that time he has not been able to make any movement with the left upper extremity.

When first seen by Dr. Bassoe on Dec. 4, 1918, he walked well but the left arm was flaccid and completely paralyzed. There was complete left hemianesthesia, involving all forms of sensation. Even a very strong faradic current, applied with a pointed electrode to the tongue and sufficient to curl it up completely, evoked no sensation. The limitation of the anesthesia at the median line was very sharp. He could not distinguish objects with the left eye, nor hear spoken words or the watch with the left ear. The tendon reflexes

and superficial reflexes were normal. The paralyzed muscles reacted normally to faradism and galvanism. Examination of the eye by Dr. Brown Pusey and of the ear by Dr. H. C. Ballenger revealed no lesion of these organs.

Several faradic treatments have been given without any change in the patient's condition.

CASE 2.—A private soldier, aged 37, a railroad switchman by occupation, enlisted in the engineering corps and worked on the railroads in France some distance from the firing line. In August, 1918, while on a furlough he spent the night at a hotel in Rouen. During the night an enemy airplane dropped a bomb which exploded outside the hotel with sufficient force to throw him out of bed, but he was not injured. Thirteen days later while getting on a train far away from the battle-front he fell off the last car but was not injured, though stunned and frightened. He began to tremble all over, could not speak above a whisper, nor feed himself. After a time the tremor became limited to the right leg and has persisted.

Tremor of the right leg was the only symptom when the patient was first seen by Dr. Bassoe on Dec. 6, 1918. He improved somewhat and felt sufficiently encouraged early in January to return to his former occupation of switchman. He worked only three days, however, when he became extremely nervous and finally so excited that he was unable to walk away from the railroad yard and an ambulance was called to take him home. No evidence of organic disease was elicited.

CASE 3.—A young soldier, whose mother is nervous, while in camp in this country, in June developed a coarse tremor in right leg. This was the principal feature when the patient was seen on Oct. 23, 1918. There was also moderate tremor of both hands. The reflexes and sensation were normal. No signs of organic disease.

CASE 4.—A private soldier, aged 30, formerly a telephone operator, was said to have had a sunstroke while in the Army. He had nervous attacks with trembling and palpitation, and in December, 1917, was discharged from the Army with a diagnosis of multiple sclerosis. Examination by the writer in August, 1918, failed to reveal any signs of organic disease. He was apprehensive and nervous, with a coarse tremor of both hands.

In most of the nervously disabled soldiers seen by Dr. Bassoe there has been an association of local trauma and superadded hysterical phenomena. Examples are the following:

CASE 5.—A private soldier, a Polish Jew, aged 23, fell off an army wagon in September, 1917, and sustained a fracture of the right foot, which healed without deformity. When examined in August, 1918, he could barely step on the foot, all foot movements appeared to be very weak and to cause pain. An orthopedic surgeon called in consultation found no physical cause for the difficulty. There was a little atrophy of the leg muscles, but the reflexes were normal. There was anesthesia of the entire foot and the lower half of the leg. The patient later contracted influenza and died in October, 1918.

CASE 6.—A private soldier, aged 24, a Roumanian Jew, fell on an icy walk at a camp in this country and had pain in the right arm for two months afterward. The hand was cold and blue. When examined in August, 1918, the arm was very weak and completely anesthetic. There were pseudocontractures of the wrist and fingers. The reflexes and electric reactions were normal.

CASE 7.—A soldier sprained his shoulder in October, 1917, while in camp, and following this the shoulder gradually pulled down and the back became curved. When seen by Dr. Bassoe in August, 1918, the patient presented the appearance of so-called camptocormia. This man has gone to his home. A letter recently received from him shows a mental attitude exactly like that of the usual damage-seeking, traumatic neurosis patient of civil life. He says: "When I entered the United States service I was as robust and as stout as any man, and since then I am unable to work. I have to take a measly \$30 a month when I should draw \$57.50. This is what the insurance policy calls for, but if they want to give the balance of my claim to some faker, why it is up to them. . . . They won't have a real man alive after another year of grafting."

CASE 8.—A soldier, aged 23, had served in the British Army, and at Mons, had been wounded by shrapnel in the left side of the neck, and at Loos, above the left eye. Some shrapnel and bone had been removed from the forehead. A month after the operation he began having attacks in which he stated that he would fall and become unconscious for from ten to fifteen minutes. The attacks were preceded by a sensation of a ball coming from the left side of the neck and rising into the throat. They occurred about once a week. In November, 1917, that is, about three years after his injuries, he was admitted to the Presbyterian Hospital. When first seen there he stated that he had been blind in the left eye ever since the second wound, but he was able to count fingers well with this eye and the fields were only moderately narrowed. The fundi were normal. When sensation was tested and the vicinity of the scars in the left side of the neck was touched with cotton he jumped up and said it felt like rough scratching. Immediately afterward he could feel neither cotton nor a pin prick in this region, and the same condition existed about the scar on the forehead. All reflexes were normal. The roentgenogram of the head was negative. While in the hospital he had several attacks of unconsciousness and others in which he seemed dazed and irrational. After seeing a patient's stomach aspirated he said he felt queer and then proceeded to vomit. Altogether, the attacks suggested hysteria rather than epilepsy. One attack began with a choking sensation, then he moaned with pain which passed from the left side of the forehead to the neck, and he became unconscious. On awaking he was hilarious for a time, then again moaned with pain. While in the hospital his urine showed considerable albumin and granular and epithelial casts, but he had no edema and the heart was normal. He was discharged, Jan. 2, 1918, and later admitted to the Psychopathic Hospital, where he died on May 4, 1918. A necropsy by Dr. LeCount failed to reveal any brain injury, but there was a well marked chronic nephritis, with ascites and edema. Uremia was considered the cause of death.

MENTAL CASES

CASE 9.—A musician, aged 18, fell in love with a young lady in the summer of 1916. She became pregnant and a marriage was planned. The girl was to go home for two weeks and when they parted, on looking back, he saw tears on her left cheek. He never saw her or heard of her again, as some days later he enlisted in the Army without communicating with her or letting his family know. He was sent to Panama and after six months he began to think that this girl was there. On hearing a woman behind him in the evening he would get a distinct vision of the girl's face with tears on the left cheek, and hear her sobbing. On at least half a dozen occasions he

turned around and asked, "Woman, why are you crying?" whereupon the accosted woman accused him of being drunk and he felt very sheepish. He always instantly realized his mistake, but the vision constantly recurred, always when he was looking backward. Some time ago he came back to his home town and had no sooner stepped off the train than he had the same vision and heard the sobbing, but did not dare look around. A few days later he went to the nearest military post, asked medical advice for insomnia, and requested permission to turn in his pistol as he feared he might injure himself. He had good insight and showed no other mental symptoms.

In a recent letter he states: "Through will power and the care of myself I believe this case of mine will be cured. . . . The tropics and its diseases are all I dread now and my only hope is to get out of these soon. Two years in a place with no diversion or pleasure is enough for any white man, or else insanity would not predominate the troops so." Later the Army surgeon to whom he had first applied for aid reported that the patient has given up his search for the woman, has married another and is returning to duty.

CASE 9.—In a small town near a large military establishment six or eight women within a month had been frightened by meeting a man in uniform at night who said "Look" exposed his genitals and then walked on. The police finally arrested a young man wearing the kind of uniform described and though not caught in the act he promptly confessed. He is a man, aged 24, of a good family, well educated, who never dissipated in any way and never had sexual intercourse. He admits having masturbated occasionally before enlisting at the beginning of the war. He could not give any reason for his action and showed nothing abnormal mentally except a lack of realization of the possible consequences of his actions if his identity should become known. He apparently had reflected very little about it, had not at all been upset, but readily admitted the seriousness of the matter when it was pointed out to him. Whether this exhibition is merely a feature of a compulsion neurosis in a neuropath or an early manifestation of dementia praecox remains to be seen.

DISCUSSION

DR. GEORGE W. HALL related his experience in military camps examining nervous and mental cases culled from 60,000 to 80,000 soldiers. Ordinary neurasthenics were prevalent, hyperthyroidism not uncommon but the incidence varying greatly with the habitat of the recruits. Cases of mental deficiency attracted attention because of the large number in the draft which had to be weeded out. The proportion of these also varied enormously with the geographical source. From Kentucky the mentally defective among the whites seemed to outnumber those among the colored. This would not hold for some of the other states.

A few cases of infantilism were sent into camp but were promptly dismissed because of the inevitable effect they would have on the normal soldiers. The number of malingerers was comparatively few.

The speaker reported in detail one case of *camptocormia* (bent back), a name given by Souques to cases of forward flexion of the trunk with or without lateral inclination. Many such cases had been observed during the war both here and abroad. Rosanoff-Saloff had gathered particulars of sixteen unpublished cases and had treated the condition very fully with ample illustrations. The disorder is purely or almost purely functional, and the patients generally rapidly recover when proper treatment can be given.

CAPT. HARRY R. HOFFMAN had had an experience of eleven and one-half months in camps in this country and ten months abroad as division neuropsychiatrist. He went through all the big "pushes," with the exception of Chateau Thierry, and stated that much depended on the place where the examiner was situated when he had cases of neuroses to deal with. He stated that Major Pollock, whom Dr. Patrick had quoted, saw cases which did not come to him for two weeks after they had left the firing line. The division psychiatrist was stationed directly behind the front line where mental and nervous cases were classified as well as possible and dealt with at once. All other cases of injuries were classified and sent to the evacuation hospitals. The cases of neuroses among the American soldiers could not be compared with those of the French and British, for the reason that the American soldiers always had been on the offensive and never assumed the defensive. Therefore, they rarely or never entrenched themselves for any length of time. In the battle of the Argonne, the first day of the great push (September 27), only very few cases of neuroses came in, but during the following days they began to come in rapidly. On account of unfavorable weather conditions, insufficient clothing, lack of water and scarcity of food, in a very few days they had 1,400 cases on the outside of tents, without blankets, without litters, the men practically lying in the mud with nothing to cover them but their rifles. There were also 800 at an advanced dressing station.

The majority of cases of so-called war neuroses in his opinion were exhaustion neuroses, coupled with the intense firing at the front. A large number of cases of definite neuroses were found in noncommissioned and commissioned officers. In this class there was the same exhaustive neurosis plus the responsibility. The same applied to civil life, in that very seldom did a bricklayer have nervous prostration. It was usually the higher intellectual types of men who had the exhaustion neuroses when the impending strain came. There were no cases of psychoses at the front during the active fighting.

There was great lack of facilities for treating these various conditions, and the cases could not be treated individually in accordance with orders. They succeeded, however, in sending back to the front line 50 per cent. of these patients after their faces were washed by the Salvation Army girls and hot coffee was given to them by the Red Cross. Much, he said, could be accomplished in dealing with these patients by persuasion and suggestion. The two principal factors in war neuroses were early diagnosis and prompt treatment.

CAPT. WILLIAM D. J. DE NAPHEYS corroborated the statements made by Captain Hoffman, and said that if the cases of neuroses were handled properly the men recovered to a surprising extent. The men that were picked up on the field or in the trenches were the ones that could be returned to duty if they were given a cup of coffee, a cigaret and a good night's sleep. The farther back from the firing line the neuroses cases were taken, the more difficult it was to cure them.

DR. J. O. COBB, U. S. Public Health Service, said that at present one of the great problems is that of claims. The men had found out about war insurance, and many of them had doubtless gone into the Army with the idea of getting some of this insurance. He was certain this was true of a few cases he had seen at the hospital. Some of the men coming back from overseas were not altogether heroes, and in the beginning they figured out how they were going to get some of this war risk insurance. Those who were dealing with neurotic cases knew that some of the men were worthy of good treatment from

the government, while others were not, but just where the dividing line came was difficult to determine, not only for specialists in nervous and mental diseases, but for general practitioners. The joint cases were very hard to deal with, almost as hard to deal with as the traumatic neuroses. The war was not going to end the traumatic neuroses cases—not all of them. Many of them were going to continue to be traumatic cases right along if they could get their war risk insurance; they would not get well because they were going to have this pension, and after this pension is settled on them they would get well just as the armistice cured a great many. The practitioner must be on his guard in dealing with them. Some of the traumatic neuroses cases recover because the conditions of war are ended and they are anxious to get back home and be discharged. General practitioners and specialists might have some of these men coming to them because of having been refused treatment after their discharge and refused compensation by the War Risk Bureau, and they will have to decide whether such men have genuine neuroses or not.

NEW YORK NEUROLOGICAL SOCIETY

Three Hundred and Sixty-Eighth Regular Meeting, held at the Academy of Medicine, Dec. 3, 1918

FREDERICK TILNEY, M.D., *President*

A CASE OF INTRACRANIAL INFILTRATING ANEURYSM AT THE BASE. Presented by DR. S. PHILIP GOODHART.

The patient was a middle-aged woman who gave a history of a long standing rheumatic disorder for which she had taken a number of cures. There was at present evidence of arthritis, especially of the hands and feet. She had also suffered from headaches, mostly confined to the left side. Three years ago these headaches suddenly became intense and persistent and were accompanied by a ringing sound in the left ear. To this ringing were finally added noises of different character which, after a period of six weeks, involved also the right ear. The patient noticed that the headache was less when lying down, and that she could diminish the noises in both ears by pressing deeply into the soft parts of the neck slightly below and a little anterior to the left ear, manifestly over the carotid. This also diminished the headache to a large extent. The left eyelid was edematous in the morning. There was a point of tenderness over the left mastoid, hyporeflexia of the cornea and a relative diminution of all forms of sensation over the left half of the body, doubtless purely functional. On auscultation a distinct bruit was heard behind both ears; with the aid of a soft rubber stethoscope a loud bruit could be heard in the right ear synchronous with the pulse. The eye-grounds were practically normal. Systolic blood pressure was 130, diastolic 80. Roentgenologic examination revealed no abnormal bony changes. The case was probably one of intracranial aneurysm at the base posteriorly.

DISCUSSION

DR. L. PIERCE CLARK remembered a woman who had an aneurysm of the left frontal sinus and acute exophthalmos. The condition was diagnosed first by an ophthalmologist. The ear bruit on auscultation did not decrease on sitting up; in fact, it was intensified and she had violent vertigo in lying down.

This condition was rarely diagnosed. The speaker had seen but two other cases. The only thing to be done was to use iodids, but one patient got on better by using morphin.

DR. CHARLES A. ELSBERG remarked that he had seen a metastatic new growth give exactly the same symptoms as those of Dr. Goodhart's patient.

A METHOD FOR IMPROVING THE TREATMENT OF FACIAL PARALYSIS. Presented by DR. CHARLES H. JAEGER (by invitation).

The patient was a child who three years ago had complete left facial paralysis. Following orthopedic principles which had been found to be sound in poliomyelitis, it was decided to rest the muscles, avoid irritaton and motion and prevent distortion. When the patient was brought to Dr. Jaeger, he decided that here was a chance to see what complete rest and maintaining the physiologic position and shape of the muscles would do to restore the normal tone of the muscles. The problem seemed to be one of holding up the affected muscles permanently. The simplest thing was to have some sort of a net made into a cap to fit snugly over the head and then to apply a brace consisting of two strips of adhesive plaster with attached ribbons, the ends of which could be tied into the net cap, while the cheek was drawn up to correct the sagging; or a small hook could be attached to the end of each ribbon and these hooks could be slipped into the net cap. This procedure was followed, the child willingly cooperating in the treatment, and the attachment, with frequent renewals, was worn constantly for three months. Within one week after applying the brace, the condition showed signs of improvement. The facial expression had become more natural, there was less drooping of the left corner of the mouth and the left eyelid could be more nearly closed. At the end of three months the child was entirely cured. She was not seen again for nearly two years, but three weeks ago her mother had brought her to Dr. Jaeger's office with a history of Spanish influenza and a return of the paralysis.

DISCUSSION

DR. J. A. BOOTH considered that Dr. Jaeger's arrangement of the adhesive plaster, instead of a hook to fit in the corner of the mouth, might be an improvement on a method of treatment that had been in common use for years.

DR. L. PIERCE CLARK said that after all it must be remembered that however severe facial paralysis might seem, the great majority of these cases practically recovered spontaneously. It was only in the severest grades that one might expect contractures, and then the majority of the contractures were in the line in which the splint was here applied. It might be well to see what this method would do to overcome the marked sagging following mastoid disease and injuries of the face of severe grade. In regard to hypoglossal anastomosis and the relative improvement in Bell's palsy, Sir William Gowers said that whenever the paralysis was shown, by electric reactions, etc., to have existed over three months, some part of the function of the seventh nerve would remain lost. He had a patient who had his beard trimmed by a tonsorial artist so as to make both sides of the face appear symmetrical, and the improvement was so great that his own friends did not know he was paralyzed.

DR. WILLIAM M. LESZYNSKY did not consider Dr. Jaeger's analogy between the paralyzed facial muscles and those of an extremity affected by poliomyelitis a good one; but for many years he had been accustomed to recommend

the use of a small hook inserted at the angle of the mouth, and retained in position by a thin strip of adhesive plaster fastened over the malar bone during the early stage of facial palsy, in order to give support to and prevent stretching of the paralyzed zygomatic muscles. He thought that Dr. Jaeger's idea of the application of the plaster to the skin in order to elevate and support the upper lip was preferable to the hook which occasionally set up irritation of the mucous membrane. The additional strip of plaster over the masseter, as demonstrated in this case, however, was superfluous and could be dispensed with. It should be remembered that in many cases which appeared severe at first, recovery might take place spontaneously. If recovery in bad cases could be hastened by simply keeping the paralyzed muscles at rest indefinitely, then all of the customary methods of treatment such as electricity, massage, etc., could safely be discarded. Attempts on the part of the patient at voluntary effort to move the facial muscles has always proved one of the most important measures leading toward ultimate recovery.

DR. A. P. LENSMAN, Seattle, Wash. (by invitation), said that having had a unilateral facial paralysis himself, he had tried every method to correct it, with the exception of the use of adhesive plaster, and his personal experience was that rest was not an effectual method of treatment. He had a great deal more success with diathermia, though it did not have any effect on the ptosis. The discomfort of the condition came more from the contraction than from a nerve pain, and the patient always felt very much better for some time after massage. The principle of rest for contracture did not appear to be a physiologic measure. It might be that the use of the adhesive plaster itself, its composition, had some effect on the circulation and thereby brought about the result achieved by Dr. Jaeger, but that a cure was effected by the immobility produced by the brace itself would seem to be doubtful.

DR. SMITH ELY JELLIFFE said in response to Dr. Leszynsky's suggestion that "if this form of treatment be effectual we will have to lay aside all our old methods of handling these paralyses," that he hoped that we would wake up and learn that the older methods were inadequate, if not stupid, for physiologic stimulus of muscle action was not obtainable by the old methods of massage and electricity. Real stimulus was received through the motor cortex through ideation. In recent experiments in physiologic laboratories where extensive studies on peripheral nerves had been carried out, they had shown that electrical stimulus was not a stimulus at all, and that degenerated nerve processes were not helped in the slightest by electric stimuli.

DR. RICHARD B. KRUNA said the effect of massage was the accomplishment of concentrated rest, as elimination of the products of fatigue thereby took place considerably more quickly than if the muscle were left to itself. Neither rest alone nor stimulation alone would accomplish what one wanted to achieve, but a combination of the principles of stimulation and of concentrated rest by massage and the principles of ideation together had to be utilized. In the treatment of infantile paralysis a combination of the three often gave a better total result than under the application of any single method.

DR. M. NEUSTAEDTER asked what was the condition of the palpebrarum.

DR. JAEGER, in closing the discussion, expressed his gratification that the subject had aroused so much interest from the society. He himself felt that as this was merely a single experience, one could not from this make general rules or laws governing the treatment of all cases, especially those of nerve injury during a mastoid operation. He presented the child to show results in

this particular case where electrical stimulation had been carried out for almost a year without benefit, and the opposite of this treatment, or complete rest, had brought about the most satisfactory results.

There was absolutely no similarity between this method of broad external support and Dr. Leszynsky's method of dragging up the cheek by means of a small hook placed in the corner of the mouth and fastened over the ear. The latter was unphysiologic; it produced traumatism to the already weakened muscle by attempting to carry the entire weight of the cheek on the very small area engaged by the hook. Dr. Jelliffe's remarks coincided with his own views about the regeneration of muscle; that is, that it must be a central regeneration and that the muscle should not be regarded as a single entity but in its relation with the brain and cord. It was one organ in three parts, and one could not, by applying external stimulation, expect regeneration from the muscle when the normal physiologic process was ideation and central stimulus. That was the modern treatment of poliomyelitis, and that was the way in which the speaker expected to continue to treat cases such as the one he presented. The two plasters were applied for a very definite reason: the first plaster was placed over the affected muscle, the second alongside of it to assist in supporting the weight of the cheek.

TEN YEARS OF WORK OF THE NATIONAL COMMITTEE FOR MENTAL HYGIENE AND SOME PLANS FOR ITS FUTURE DEVELOPMENT. Presented by CLIFFORD W. BEERS.

Mr. Beers, founder and secretary of the National Committee for Mental Hygiene, delivered this address by invitation of the society. He began with a brief explanation of why he published his autobiography, "A Mind That Found Itself," which was a frank description of conditions as he saw them while a patient in hospitals for the insane from 1900 to 1903. His motive in publishing his book was to organize a movement to improve these conditions and to help prevent mental disorders. Following this, he was instrumental in organizing a society with these aims in view and to do work similar to that done by another national agency in the fight against tuberculosis. The success of the National Committee for Mental Hygiene, which was founded in 1909, had in part been due to the fact that it did not antagonize the hospital officials, but gained their cooperation by proving to them that it was working also in their behalf. The preliminary plan was formulated in 1906, and in 1907 the speaker got in touch with Dr. Adolf Meyer, who believed that results could be obtained by inducing a group of psychiatrists and others to participate in forming a national committee, the purpose being to improve conditions among the insane and to institute methods for the prevention of mental troubles. In considering a title for the committee, the inclusion of all these words would have proved unwieldy, and Dr. Meyer suggested the use of the phrase "Mental Hygiene," which proved to be a very happy choice, as it included the idea of prevention.

It was not an easy matter to organize the National Committee for Mental Hygiene. The organization was founded, as stated, in 1909, but it was two and one-half years before funds for initiating the work were secured. Mr. Henry Phipps then contributed \$50,000 for the first three years of work, and Dr. Thomas W. Salmon who, during the war, had been in France in charge of the neuropsychiatric work of the American Expeditionary Forces, was appointed medical director.

There were many difficulties encountered in beginning the work, as there was no other organization's experience to draw on. In consequence, the first task was to gather reliable data regarding a variety of subjects. The most immediate necessity that presented itself was to get accurate information regarding the institutions for the insane. Before very long a wealth of information poured in.

The fact that the initial work was under the direction of Dr. Salmon was very fortunate. He at once won the confidence of every one with whom he dealt. The managements of the various hospitals welcomed the help of the committee and extended every assistance. The next work attempted, after gathering information and starting the library, was that of surveys. The method of making these was to send a well-trained psychiatrist into a state to make a personal study of the situation, yet not necessarily to look for abuses. The committee did not resort to unwise publicity by overfeaturing shortcomings, but tried to enlighten the public as to actual requirements so that, when necessary, new laws should be enacted. Twelve or fifteen surveys had been made to date, with funds provided for that purpose by the Rockefeller Foundation, except in South Carolina, Texas, Wisconsin and Pennsylvania, which were financed in other ways. After a report of the conditions existing in South Carolina was made to the legislature of that state, it appropriated \$500,000 for a new institution, and today South Carolina had a modern state hospital, whereas prior to that, conditions were on the same low scale that obtained fifty or more years ago. The people of Texas made an appropriation of \$600,000 for the remodeling of one old institution and the building of one new one, for it had been found that for lack of places to care for them the insane were held in jails and almshouses. Similar conditions were common in other states, which, fortunately, however, were fast decreasing in number. It was the hope of the committee that in time the entire country might be surveyed. If funds for this sort of survey work continued to be available it would be possible to put an end to the so-called legislative investigations which did more harm than good, as surveys made such legislative investigations unnecessary.

The activities of the National Committee also included work in behalf of the feeble-minded. Indeed, this phase was developing more rapidly than any other. Surveys, as was to be expected, formed an important part of it, and far-reaching effects were being produced in a number of states. Another special activity consisted of the studies in the psychopathology of crime. Many of those present were familiar with the work of Dr. Bernard Glueck at the Psychiatric Clinic at Sing Sing Prison, which had been supervised and financed by the National Committee. His studies led him to the conclusion that the mental factors were the main ones in the problem of crime, and must be considered in any efforts at prevention of crime. The work done at this clinic had already influenced the management of crime in these states.

Another activity lately started was the Bureau of Uniform Statistics of the National Committee. Statistics of mental diseases were most inadequate, and in addition had heretofore not been gathered on a uniform basis. Within the past year, however, 144 of the 1,500 hospitals for the insane in the United States had agreed to use uniform statistics blanks, all of which were sold to them at cost by the committee. The work was also being extended into Canada, where the idea was cordially welcomed. In time dependable statistics on mental diseases would be available.

These were some of the committee's special activities. The National Committee was carrying on educational propaganda, which was having its effect,

not only among physicians, but among the general public. Mental hygiene exhibits had been found to be most useful in enlightening the public, as were public lectures. It was the intention of the committee to create as soon as possible new exhibits with duplicate sets for lending purposes.

When the phrase "mental hygiene" was adopted, more was accomplished than was realized at the time. The solution of the problems of feeble-mindedness, prostitution, vagrancy, delinquent children, were all included under the term "mental hygiene," so the scope of the work originally planned had been greatly extended.

Because the National Committee was already in existence when the United States entered the war, it was used as a rallying point, and was able to lay out plans for the United States Government in providing proper care for the nervous and mental cases in the Army. Through the war work of the committee some 50,000 recruits had been rejected for various nervous and mental conditions, and the analyzing and classifying of these cases would provide wonderful material for research into the causes of these conditions. The war had undoubtedly done a great deal for the sciences of neurology and psychiatry, especially in the way of securing public recognition of their importance.

Some eighteen state societies for mental hygiene had been organized in this country and a number of states. It was hoped that within a few years all states would be organized, and all of them would have such agencies. Furthermore, an international movement had been begun. The speaker had personally organized the committee in Canada, where he met with the most enthusiastic cooperation, some of the most prominent people in the Dominion having taken a personal interest in getting the work under way. Meetings were held at Quebec, Montreal, Toronto and Ottawa, and everywhere the movement was most cordially indorsed. A report had lately been received from the Canadian National Committee (which was only 6 or 7 months old) showing wonderful results. It was doing war work, carrying on studies of different kinds, notably in regard to immigration and the correction of laws, and in regard to juvenile delinquents, etc. After ten years of work it might safely be predicted that the mental hygiene movement had come to stay, and that it would in time spread to all parts of the world.

DISCUSSION

DR. L. PIERCE CLARK said that Mr. Beers had presented the problems confronting the Committee for National Hygiene and the work they were doing in so fascinating a manner and so completely that there was hardly anything left to be said. It was surprising to note what they had accomplished while laboring under the disadvantage of being so shorthanded and having such a small amount of money, and yet the good will and good offices of the different members of the committee were always generously furnished. Dr. Salmon had once said he hoped the time would come when the committee would get all the obvious work done through laymen and the medical profession as a whole, and then be able to turn its attention to research and investigation. Of course, there had already been research and investigation in the directions mentioned by Mr. Beers, but there was still considerable to look forward to in the functions medical hygiene would meet in the domain of research. One of the most important functions in future of the National Committee should be to search into the nature of the economic and social factors that played a rôle in the induction of mental disorders. To carry this out to best advantage,

there should be mental hygiene clinics where all types of conduct disorders could be investigated and treated on the basis of their causative defect. The scope of such a clinic should embrace such general conduct disorders as defective nursery ethics, disorders of puberty and adolescence, and lying, thieving and swindling, before they advanced so far as to require legal measures. Unfortunately, in the past many of these patients had been sent to medical clinics where they were not given proper attention, as they had only too frequently been considered as nonmedical. There should also be departments in the clinics which would deal with defective adaptations in the domestic relations, and with economic and social maladjustments. The coming need at present, so far as could be foreseen, was to socialize a part of the psychiatric activity outside the institution and clinic per se, and make it a real part of the community life. It had already been learned that one had to reach the individual at an early period of life, and therefore earnest attention should be given toward reaching back in point of time toward the earliest life of the psychopathic individual, so it was worth while considering whether the Committee for Mental Hygiene could not establish an ideal type of clinic of mental hygiene to be worked out first in some large city. Educating the schoolchildren should be handled scientifically, and an effort made toward a better attitude and relationship to society as a whole. Some of the functions of mental hygiene were gradually being extended in the courts. To do this work, there had to be trained workers. The social workers, the individuals who had cared for society's psychiatric attitude toward the public, needed to be augmented. There was opportunity here for the after-war activity of the intelligent men and women who had been engaged so earnestly in war work committees, Y. M. C. A. enterprises, etc., and from them would come a great revival of humanistic interests helping the whole problem of mental hygiene in research as well as in practical activity. If this idea could be arranged and developed it would serve a great function for the future and would prove of benefit to the whole community as well as those psychopathically inclined. It was time for the fields of psychiatry and neurology to be regenerated, and this could come through an extension into peace conditions of the reconstruction planned during war.

DR. SMITH ELY JELLIFFE said that from the beginning of the movement which Mr. Beers started, he had felt, in watching its gradual evolution, that a real genius for this type of work, an account of which has been epitomized here tonight, was with us, and in all activities of our related societies he felt sure that no one could do more than to lend hearty support and cooperation to work so ably started and so ably carried on.

Book Reviews

WAR NEUROSES. JOHN T. MACCURDY, with a Preface by W. H. R. RIVERS, M.D. The University Press, Cambridge, 1918.

This book represents a revision of an earlier paper published in the *Psychiatric Bulletin*. What differentiates it from other studies on war neuroses is MacCurdy's attempt to trace the development of, and the forces at work in, these neuroses from the psychological point of view; and he does it very cleverly and convincingly. According to MacCurdy the fundamental reason for the breakdown is as follows: There is normally in every one a deep primitive instinct toward brutality repressed by forces belonging to the instinct of gregariousness or the social instinct. In war a premium is put on blood thirstiness, hence here the primitive instinct finds an outlet which on account of the duty involved also satisfies the social instinct. This is what we call a sublimation. This sublimation is more difficult to maintain in the present trench warfare than formerly, because there is no compensation by the excitement of more active operations, by satisfaction from hand to hand fight, joy in general prowess, etc. The breaking down of this sublimation, the consequent inability to adapt to the situation and the assertion of the selfish instinct of self-preservation then bring about the neuroses. He tells us that officers develop chiefly "anxiety states," while privates develop "conversion hysterias." It could be shown that at a certain stage symptoms appear that seem to be specifically directed against the individual's capacity to fight, and it is important that MacCurdy's questioning revealed the fact that both types of cases have at one point a conscious desire for release—the privates in the form of a disabling malady, the officers, whose greater sense of responsibility does not permit them to play with any failure to meet responsibility short of death (which also represents a sacrifice), in the form of a wish for death. How the wish for a disabling malady in the private leads to a conversion hysteria is, of course, simple enough. The hysterical symptom represents the fulfillment of the wish and the patient's attitude toward it is much like the attitude of a man toward a wound. The transformation of the death wish into an anxious state is more complicated and the theory advanced by MacCurdy can scarcely be more condensed than the form in which he gives it in his chapter on General Psychological Considerations, to which the reader is referred. It might here be added that MacCurdy, like many others, observed that wounded soldiers do not develop neuroses, obviously because the wound represents a release which makes that of the neurosis unnecessary. On the other hand, a neurosis may later arise when the return to the front again becomes imminent. MacCurdy also devotes a chapter to heart neuroses. We shall here speak only of the conversion hysterias and the anxiety states.

The inquiries regarding the make-up have not infrequently shown certain difficulties of adaptation before the war. In ordinary life the most difficult adaptations are those connected with the sexual instinct, and although this is not involved in the war neuroses it is the constitutional defect behind this which makes the patient liable to succumb to the strain of the war. Therefore, inquiry into the make-up is made to get a rough idea of how resistant the patient had been to the most disturbing influences of life.

Evidently when getting to the firing line an initial fear, even with desire to run away (appreciated as absurd), is very common, as is also horror at seeing mangled remains of others, and the like. This first reaction to the war situation is very interesting. It either is represented, as we have just said, by fear, less commonly by a kind of spurious elation, facetious remarks and motor tension. Still more unusual is languor accompanied by depressive affect or lethargy which may be so marked that the man goes to sleep. None of these symptoms are indicative of the degree of future adaptability. But all these situations are adapted to by the great majority.

Just as the peace neuroses are preceded by a gradually growing difficulty in adaptation, so we find it here. The first symptom of the anxiety states is fatigue, caused by obvious physical factors, but also by mental ones, such as the routine, the demands for constant alertness, speediness of decision, complete self-confidence, spontaneous eagerness, etc., all of which have to be maintained for hours or days often without sleep, adequate food, etc., and a great many other factors. The symptoms of this fatigue are tenseness, irritability, difficulty in concentration, tendency to start at sounds, especially shells. At the same time we find difficulty in getting to sleep, hypnagogic hallucinations with repetition of day scenes but with insight and without fear. The dreams are also repetition of day doings, but represent the situations in such a way that the patient does not get anywhere. There is sudden waking up with a jump. This of course interferes with sleep. Then with the real breaking down of the sublimation comes fear and horror at the sights around him, obsessional dwelling on the difficulties, inability to keep his mind from injury, general thoughts of pacifism and pity for the enemy. Then also inability to say where the shells came from, fear about them and fear of being unable to hide the fear. At this stage MacCurdy always found that the patient retrospectively gave an account of conscious desires for some release which, as we have said, in officers do not take the form of incapacitating wounds or being made prisoner (although the latter is dreamed about at this stage) but of death which represents the most complete release, and is moreover compatible with standards of duty. Therefore, at this stage we find not infrequently reckless acts, also thoughts of suicide performed in a way which could not be considered as such. When thus the death wish is fixed, the patient has arrived at a stage when a physical or mental accident precipitates a complete breakdown. Such accidents are an explosion of a shell, horrible sights, dangerous situations, burial with earth thrown over him. But the precipitating situation may also be produced by a refusal of leave which was expected, and the like. Explosion of a shell may produce either a brief unconsciousness by actual concussion or may poison the individual with gas, whereas burial seems to act merely on the basis of a mental shock. The acute symptoms may be ushered in with stupor which was not observed by MacCurdy, since he saw the patients later, but, based on what the patients told him and on what others observed, he assumes very reasonably that the latter may be organic or functional. The functional stupor may represent the "acme of fear" (immobility, trembling, sweating, shallow breathing, dilated pupils) followed by a dazed stage with inactivity, numbness, etc. In other cases the hypnagogic hallucinations at once pass over into states associated with fear and with a content of men advancing with bayonets, etc. More particularly there are now pronounced nightmares with marked fear. They also have a similar war

content. All this increases the fatigue greatly. There may be low blood-pressure, tremors, abasia, certain thyroid symptoms, and always a drawn, fatigued, strained facial expression. Then the patients suffer from their own lack of sociability and spontaneous affections. There is also impotence. When the acute symptoms gradually disappear, the dreams become more like those of civilian life, and whereas the dreamer before was powerless he now begins to show fight and finally to punish the enemy. What remains, then, is a certain nervousness, a feeling of incompetence and lack of desire to return to the front.

In the conversion hysterias the fatigue is never so severe as in the anxiety states. Often there is distinct diurnal dissatisfaction, while the conflicts seen so often in the anxiety cases are rare. Then there appears a distinct wish to be wounded, to get a "Blighty one." If at this stage an accident happens, the patient finds himself after it with hysterical symptoms such as mutism, deafness, motor monoplegias, pareses, tics, spasms, contractures, tremors, gait disturbances, various forms of anesthetics, hyperesthesias, paresthesias, blindness, etc., the special form being determined often by former illnesses affecting the particular function, association with slight injuries in the region chosen by the symptoms, and the like.

The treatment may be left to the reader to look up in the original.

The reviewer also considers a most important part of MacCurdy's study his attempt to differentiate between organic and nonorganic stupor and between real concussion and the result of mental shock. He does this largely on the ground of our knowledge of organic reactions in general. For real concussion speaks—aside from focal symptoms, the possibility of blood in the spinal fluid, and the like—the fact that when, subsequent to unconsciousness for several hours and days, consciousness is regained there is a constant tendency to again "dip," that is, for consciousness again to become clouded, also distinct evidence of lowered mental tension shown in difficulty in mental operations, defective orientation, poor memory for old and especially recent events, together with aphasic tendencies. This mental tension defect may in severer cases last for a long time. It may at first be associated with a delirium.

The chapters are devoted to (1) introduction, (2) typical cases, (3) anxiety states, (4) mental make-up, (5) fatigue, (6) concussion, (7) treatment of anxiety states, (8) conversion hysterias, (9) heart neuroses, (10) general psychological considerations, and (11) prophylaxis. In a short review we can, of course, not enter into all these chapters, all of which are fully illustrated by cases (twenty-seven in all) and we must be satisfied with the short sketch of the essentials given above. The book is a most interesting and valuable study. Only one point should be added. While MacCurdy has laid his main stress on the mental side, he also, as has been shown, goes thoroughly into the evidences of actual concussion when they are present and he moreover constantly refers to evidence of endocrine disorder, which, however, he regards largely as secondary. This brings up the old quarrel of organic versus psychogenic. It seems to the reviewer that it is perhaps always better, instead of speaking of psychogenic causes, to speak of demands for psychobiologic adaptation. In these, endocrine mechanisms are naturally more or less involved. The analyses in both directions will, however, necessarily have to be carried on with a certain independence of each other until, their interdependence being clearly established, we are able to see the entire reaction as a whole.

NEUROPSYCHIATRY AND THE WAR: A Bibliography with Abstracts.

Prepared by MABEL WEBSTER BROWN, Librarian, The National Committee for Mental Hygiene. Edited by FRANKWOOD E. WILLIAMS, M.D., Associate Medical Director. Also, the first supplement to the above volume published under the same auspices in October, 1918.

By the publication of the above volumes the National Committee for Mental Hygiene has placed the neuropsychiatrists of the English speaking nations very much in their debt. All the literature bearing on neuropsychiatric subjects arising out of the war has been collected and each article abstracted in detail. The contents cover Australian, British, Canadian, French, German, Italian, Netherlands and Russian literature, also the literature of the United States. In the supplement Scandinavian literature also finds a place.

The work represented is really immense and the quality of the abstract is excellent. The officers of the National Committee for Mental Hygiene, responsible for this publication, are to be congratulated.

SEALE HAYNE NEUROLOGICAL STUDIES. Edited by Arthur F. Hurst, M.A., M.D., Oxon. F.R.C.P., Major, R.A.M.C.; officer-in-charge, Seale Hayne Military Hospital, Newton Abbot. Published by Humphrey Milford, Oxford University Press. Vol. I, No. 1, July, 1918. Issued every two months. Annual subscription, 21 shillings.

This series of studies is published with the object of supplying, however inadequately, some information concerning the nature, diagnosis and treatment of war neuroses to those less fortunately placed than the staff of the hospital, and at the same time to make public the results of their scientific investigations. Sir William Osler states in an introductory note that from personal observation he can testify to the rapidity and permanence of the cures which are effected by relatively simple methods.

Contents: Studies on hysteria consisting of eight articles:

- (a) Pharyngeal anesthesia by Hurst and Symns.
- (b) Experimental observation on the signs and symptoms of malingering, hysteria and organic nervous diseases by Hurst.
- (c) Narrow and spiral fields of vision in hysteria, malingering and neurasthenia by Hurst and Symns.
- (d) The supposed association of hysterical anesthesia of the external ear with hysterical deafness by Hurst, Symns and Gainsborough.
- (e) A new group of hysterical "stigmata" by Hurst and Symns.
- (f) Hysterical Romberg's sign by Hurst and Wilkinson.
- (g) The rapid cure of hysterical symptoms in soldiers by Hurst and Symns.
- (h) War contractures—localized tetanus, a reflex disorder of hysteria by Hurst.

In the Studies on Hysteria the authors show very conclusively the action of suggestion in causing the particular objective signs and symptoms.

The rapid cure of hysterical symptoms in soldiers is performed by methods of suggestion and persuasion carried out in an atmosphere of optimism and, of course, backed up by the absolute conviction of the physician that such conditions are practically immediately curable. Major Hurst states that he now rarely uses hypnotism and only infrequently resorts to the use of electrical currents. This has been, I believe, the experience of most men interested in this line of work in military hospitals. In my personal experience I

have found the use of electricity an easy way of rapidly establishing an atmosphere of curability and when this is once established it becomes less and less necessary to resort to its use.

Major Hurst insists on what we have found to be very essential and that is that the treatment once begun should be carried to a complete successful termination at one sitting in spite possibly of the apparent fatigue of the patient and the very definite fatigue of the operator. Unless this be done many needless weeks of tiresome reeducative treatment become necessary.

Archives of Neurology and Psychiatry

Vol. I

APRIL, 1919

No. 4

DISTURBANCES OF SPATIAL ORIENTATION AND VISUAL ATTENTION, WITH LOSS OF STEREOSCOPIC VISION *

GORDON HOLMES, M.D. (LONDON, ENG.)
Lieutenant-Colonel, Consulting Neurologist, B. E. F.

AND
GILBERT HORRAX, M.D. (BOSTON)
Captain, M. C., U. S. Army

The following case is placed on record as it is an excellent example of a type of special disturbances of vision which claim our interest, not only on account of their relative rarity, but chiefly because they throw considerable light on the functions and modes of activity of the cerebral cortex, and particularly on those processes which are concerned in the integration and association of sensations.

The case is described at length as the patient exhibited many symptoms which could be fully understood only when carefully studied and analyzed. We were particularly fortunate in that he was an intelligent, willing and objective witness, and had no disturbances of speech, or motor or sensory symptoms that could complicate our observations. On the other hand, we have made our discussion of his condition as concise as possible with due regard to clearness, more especially as one of us has recently recorded six other cases with more or less similar symptoms, apart from the loss of stereoscopic vision, and there dealt more fully with their nature and significance.

REPORT OF CASE

History.—The patient, Private W. F., aged 30, had been a circular saw operator and was an intelligent and fairly well educated artisan. He was wounded May 19, 1918, probably by a machine gun bullet, but as he became at once unconscious and remained so for several days, it was impossible to obtain an accurate history. He was admitted on the same day to a casualty clearing station with a perforating wound of the head; both entrance and exit wounds were excised, fractured bone removed, softened and extruding brain-matter evacuated, and the scalp excisions were then sutured. The patient, however, remained still unconscious, vomited repeatedly and had several epileptiform fits which affected chiefly his left side. On the sixth day he asked for food, and it was recorded in his notes that he could then see.

* Passed for publication by the War Office, British Army Medical Service.

Examination.—When he came under our observation in a base hospital on June 2, the wounds were healed. The entrance, on the right side, was represented by a horizontal incision 6 cm. in length, under which a trephine opening 4 by 5 cm. in diameter could be felt; its center was 6 cm. above theinion and $5\frac{1}{2}$ cm. to the right of the middle line of the skull. The exit wound was also represented by a horizontal incision over a trephine opening 2 by 4 cm. in diameter, with its center 10 cm. above theinion and $5\frac{1}{2}$ cm. to the left of the mesial line (Fig. 1). A roentgenogram revealed only these operative defects in the skull and a linear fracture connecting them.

When he arrived at the base his general condition was satisfactory, and he was alert and intelligent. There was no trace of weakness, incoordination or disturbance of muscle tone; he could move his limbs easily and

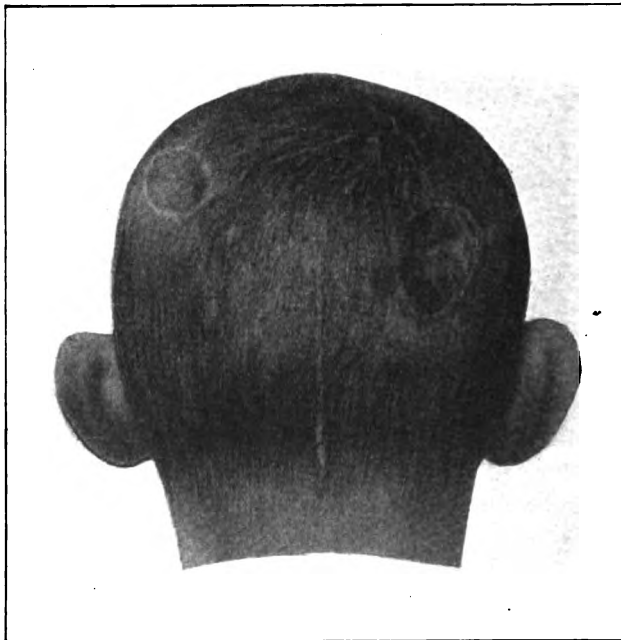


Fig. 1.—Posterior view of the patient's head on which is indicated the position of the wounds of entrance and exit. The central white line indicates the mesial sagittal plane.

employ them naturally in all actions. No affection of sensation could be detected, and his reflexes were also normal. The movements of his face, tongue, palate and jaw were undisturbed. There was no squint and he did not complain of diplopia. His pupils were large, but reacted perfectly to light, and hearing was also normal in both ears. Speech was unaffected; he expressed himself readily and correctly, understood fully all that was said to him, and named promptly all objects he recognized. He could write correctly though owing to his visual disturbances he frequently placed the words he wrote irregularly on the paper. His difficulty in reading, which did not depend on an aphasia, will be dealt with later.

During the three months he remained under our observation he appeared an intelligent and cheerful man; his attention, apprehension and memory were intact, and he was never unnaturally emotional. He also proved in all our investigations to be an extremely good and objective witness, who did not attempt to interpret his sensations, but merely described what he perceived.

Vision.—The acuity of his central vision was never seriously affected. Fourteen days after he received his wound he could count fingers and recognize objects, and when tested a few days later he read words in $\frac{1}{8}$ inch print; five weeks after the infliction of the wound his vision was 6/12 in each eye, and when his error of refraction—slight myopic astigmatism—was corrected it rose to 6/9 and Jaeger 1. His optic disks and fundi were normal. He had never noticed any visual *aurae* or spectra, as flashes of light or color. The visual fields were at first much contracted; Major G. Derby, who kindly tested him with a perimeter, found that he could recognize a white object 1 cm. square only in the right upper quadrants and within 30 degrees of the fixation point. On July 15 vision to small objects extended to the normal limits in both upper quadrants, but the lower remained permanently blind; the blindness reached to 2 degrees from the fixation points and corresponded approximately to the horizontal radii through them, except to the right where vision had recovered a slight distance below them (Fig. 2). This inferior horizontal hemianopia remained unaltered till he was transferred to England more than three months after the infliction of the wound. Though he was repeatedly tested, no scotoma or amblyopia could be found in the upper seeing quadrants. There was no agnosia, in the sense that he was unable to recognize the use and nature of objects which he could perceive by either central or extra-central vision.

Important Symptoms.—The special symptoms which give interest to this case were investigated repeatedly between 36 and 100 days after the infliction of the wound. They varied very little during this time, but they will be described here chiefly as they were observed in the later portion of this period.

There was no evidence of any ocular palsy; he moved his eyes to order readily and accurately in every direction, but from the day he first came under observation he had much difficulty in fixing objects which he could see. If spoken to suddenly he first stared in a wrong direction and then moved his eyes about until they fell, as if by chance, on the observer's face; he was extremely slow and inaccurate in his attempts to fix or bring into central vision any object when its image fell in the periphery of his retinae, especially if it were small. When, however, requested to look at his own finger or to any point of his body which was touched he did so promptly and accurately, moving as a rule both his head and eyes in the normal manner. Except in the early stages of his illness he had no difficulty in maintaining fixation on an object that was in central vision; each time, for instance, his visual fields were examined he succeeded in keeping his eyes on the fixation point of the perimeter, but if they deviated from it for even a moment he was slow and awkward in finding it again. When an object at which he was staring was moved at a slow and uniform rate he could keep his eyes on it, but if it was jerked or moved abruptly it quickly disappeared from his central vision.

This difficulty in obtaining fixation and in bringing objects seen into central vision diminished considerably, but did not disappear completely while he remained under our observation. He generally turned his eyes promptly and accurately toward any unexpected sound, but not to light; when at night

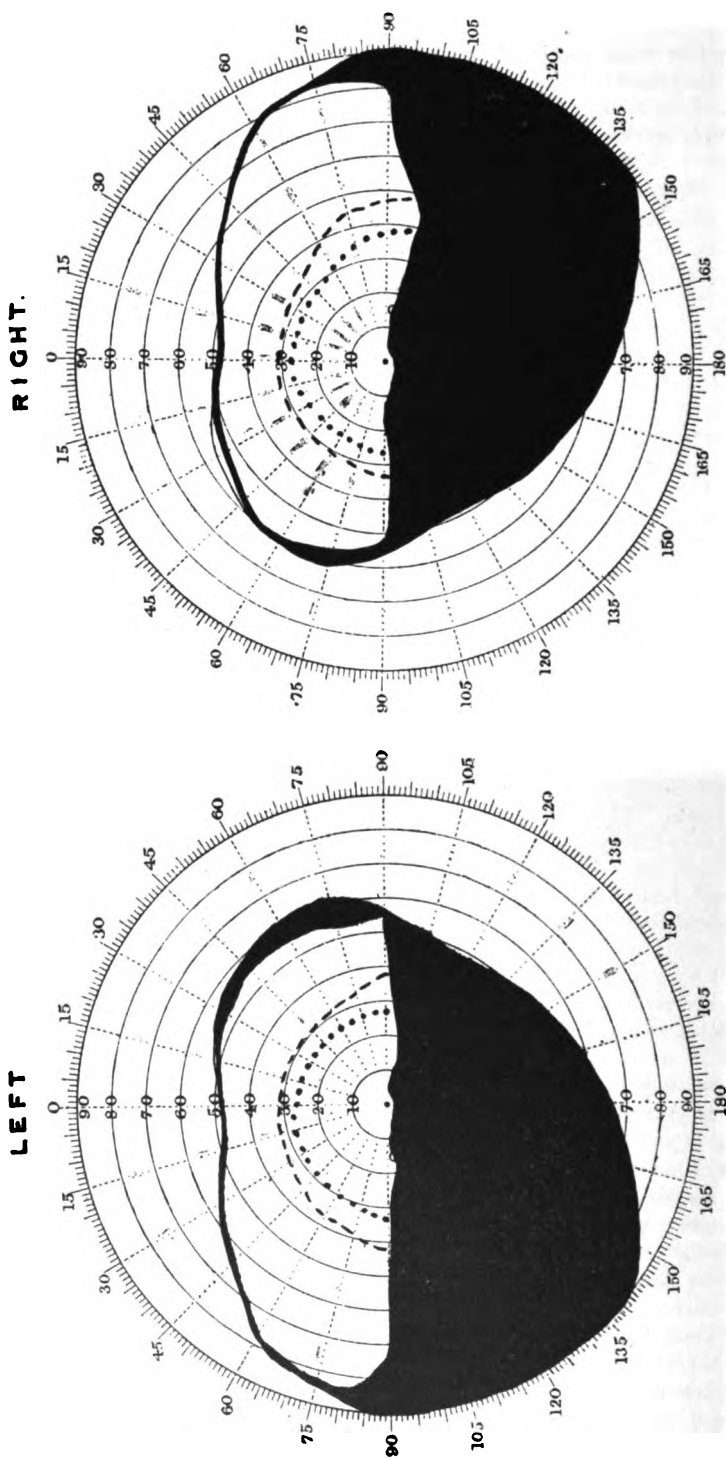


Fig. 2.—Visual fields recorded with 10 mm. square white and colored objects on Aug. 3, 1918. The broken line indicates the limit of red vision; the dotted line the field for green.

an electric torch was suddenly flashed at various points around his bed he turned his eyes slowly, and less accurately than a normal person, in the direction of each flash.

Accommodation for near objects was even more severely affected; when a pencil was moved slowly toward his eyes these failed to converge, and his pupils did not contract; when it had come within 8 or 10 inches (20-25 cm.) he could no longer see it distinctly and was conscious only of the presence of a moving object, the shape or form of which he was unable to recognize. If, however, his own finger were moved passively toward his face, or if he brought an object held in his own hand toward it, his eyes converged normally on it, his pupils contracted briskly and he accommodated so that he could see it distinctly when it was only $4\frac{1}{2}$ inches (12 cm.) distant from his eyes. He also converged accurately and his pupils contracted promptly when he was asked to look at the tip of his own nose.

Another noteworthy symptom was the complete absence of the blinking reflex; if the observer's hand or any large object, as a book, was unexpectedly swung toward his eyes he never blinked, withdrew his head, or reacted as the normal person does, unless the movement produced a current of air sufficient to attract his attention. On one occasion he explained, "Your hand seemed to come nearer to me, but I had no idea how near it came, I thought it was plenty far off." But on another day he said, "I did not see that it was coming toward my face." If, however, his own hand was suddenly jerked by the observer toward his eyes he always reacted normally to the threat.

His visual memory, for both form and color, of impressions obtained in earlier years was apparently intact; he was evidently a strong visualist and described as a visualist does his house, his family, a hospital ward in which he had previously been, etc. But, on the other hand, he had complete loss of memory of topography; he was totally unable to describe the route between the house in a provincial town in which he had lived all his life and the railway station a short distance away, explaining "I used to be able to see the way but I can't see it now." From his statements it was evident that he had formerly a clear visual picture of it which he could no longer evoke. He was similarly unable to say how he could find his room in a barracks in which he had been stationed for some months, or describe the geography of trenches in which he had served. His visual retentiveness was also defective; when he was, for instance, shown in rapid succession four objects, as a key, pencil, scissors and knife, he could never name them all or remember the correct sequence after an interval of 20 seconds, though after an even longer interval he could always repeat accurately four or more words which were uttered to him.

Visual Inattention.—There was one disturbance of vision which had so much influence on his other symptoms that it must be more fully described. As mentioned already he had, as far as could be judged, normal or practically normal vision to the natural limits of the upper quadrants of his visual fields; these were repeatedly explored and even when small white objects, 2 mm. in diameter, were used no defects could be discovered, and the color fields within them were also normal. When the observer's two hands were held up, one on either side of his visual axes and at equal angles from them, he could always perceive the slightest movement of either when it alone was moved, but he failed constantly to recognize the simultaneous movement of both hands and saw indiscriminately that to his right or left only.

It mattered not whether the observer's two hands were near his visual axes or far lateral to them, he failed to perceive the simultaneous movement of both though he always recognized the slightest movement of one or the other. Even when he held up his own hands in the seeing portion of his visual fields he stated that while his eyes were fixed on some other object he could see only one at a time, either that to his right or to his left, according as his attention was attracted by it.

In one test, while he fixed his eyes on a needle which was stuck in a table, two pencils, a red and a yellow one, were placed 5 cm. on each side of it, at a distance of 50 cm. from him; then while gazing at the needle he could see one pencil only, and indiscriminately that to his right or left. Similarly when a box was placed in front of him so that two of its sides made equal angles with his visual axes he could, while he looked at its edge, see one side only but not both simultaneously; he explained, "I can see one side, but my eyes can't get past the corner." Even if his two index fingers were placed on the two visible surfaces he could see one only if he fixed the edge of the box; and when one side was colored blue and the other remained white he saw only one, but in addition a blue or a white "streak" which he did not associate with the idea of a box.

This inability to perceive and recognize movement and objects under certain conditions cannot be attributed to blindness or hypo-esthesia of parts of the seeing quadrants, for in the first place no such disturbances could be detected though searched for several times; and secondly, he constantly failed to perceive the images of objects that fell on portions of his retinae which immediately before or afterward were obviously sensitive to the same impressions. The essential feature was his inability to direct his attention to, and take cognizance of, two or more objects that threw their images on the seeing portion of his retinae. As this occurred no matter on what parts of his retinae the images fell, it must be attributed to a special disturbance or limitation of attention, but visual attention only was so affected as he did not behave similarly to tactile or other impressions.

It might be expected that as a result of this affection of visual attention he would be unable to see the whole of large objects presented to him at a near distance; but, provided part of the image did not fall on the blind portions of his fields, this was never obvious in examination. He recognized objects and even complicated geometrical figures as promptly as normal persons, and apparently without exploring them fully by movement of his eyes. He explained this by saying, "I seem to see the whole figure in the first glance," though he occasionally failed to do so if some peculiarity or prominent portion of it at once claimed his attention. In one test, for instance, a large square was drawn on a sheet of paper and he recognized it immediately, but when it was again shown to him after a cross had been drawn in its center he saw the cross, but identified the surrounding figure only after considerable hesitation; his attention seemed to be absorbed by the first object on which his eyes fell. He could recognize as promptly and as accurately as several normal persons who were tested as controls, the shape and nature of small objects placed in various portions of the seeing fields, when they were exposed singly to him by allowing screens in front of them to drop.

Spatial Orientation.—The most prominent symptom, however, from the time he came under our observation till he left the hospital three months later, was his inability to orientate and localize correctly in space objects

which he saw. When within the first few weeks he was asked to take hold of or point to, any object, he projected his hand out vaguely, generally in a wrong direction, and had obviously no accurate idea of its distance from him. His failure to touch or point to objects seen could not be attributed to ataxia, or to any motor or sensory disturbance, as both the movement of his limbs and their sensibility were intact, and he employed them naturally and expertly in all action that did not require visual control. Other observations which will be recorded will leave no doubt that these symptoms were due to his visual disturbances only.

It was only during the first few weeks that he made gross errors in pointing to a test object that was in central vision, but even thirteen weeks after the infliction of his wound he frequently failed to bring his finger accurately to or pick up small objects, though he had learned by experience their distance from him. His errors were indiscriminately to either side of, or above or below his aim, and not predominantly in any one direction. If the object was not in central vision his errors were much greater; when, for instance, he attempted to touch the observer's finger while his eyes were fixed on his face he generally brought his hand several inches to one or other side of it. This inability to localize in space objects outside central vision was repeatedly investigated by the aid of a perimeter. A piece of white paper 10 mm. square was suddenly presented to him on the arc of the perimeter while his eyes were directed on its fixation point, and he pointed to it immediately on recognizing it.

In Figure 3 the Arabic numerals indicate the actual positions of the test object and the corresponding Roman figures the positions in which he judged it to be. As a rule he estimated the object seen to be nearer his visual axes than it actually was, but this was not constant. As he was aware of the distance of the arc from his eyes and knew that this did not vary, erroneous estimation of the distance of the object cannot account for these mistakes, and it is improbable that they were due to any disturbance of retinal sensibility for none could be detected. Further, when the same test was applied to two men who, as a result of occipital wounds, had large scotomas with surrounding zones of amblyopia in which white appeared indistinct and colors could not be recognized, it was found that both could localize the object correctly when they could see it, even if it lay in the amblyopic area of their visual field. An acromegalic with a large area of temporal amblyopia in one eye also orientated objects perceived in this amblyopic region much more accurately than our patient.

This defect could be observed in all actions of his ordinary life in which he relied on visual guidance; he had to grope for his food and any thing he wished to pick up, but his trouble ceased the moment he touched it.

His errors in the estimation of the distances of objects seen were even greater and more obvious, whether they were in or outside central vision. If the object he wished to touch was within easy reach he almost invariably projected his hand beyond it, and there was consequently an apparent tendency to overestimate distances; but when it was beyond his arm's length he often attempted to grasp it before his hand had reached it. He was consequently liable to overestimate or underestimate distances. In these tests he frequently complained that he had "no idea how far it was from him."

He had never any difficulty in *localizing by touch*; when any point on his own body was touched while his eyes were covered he brought his finger to it with normal promptness and accuracy. The contrast between the

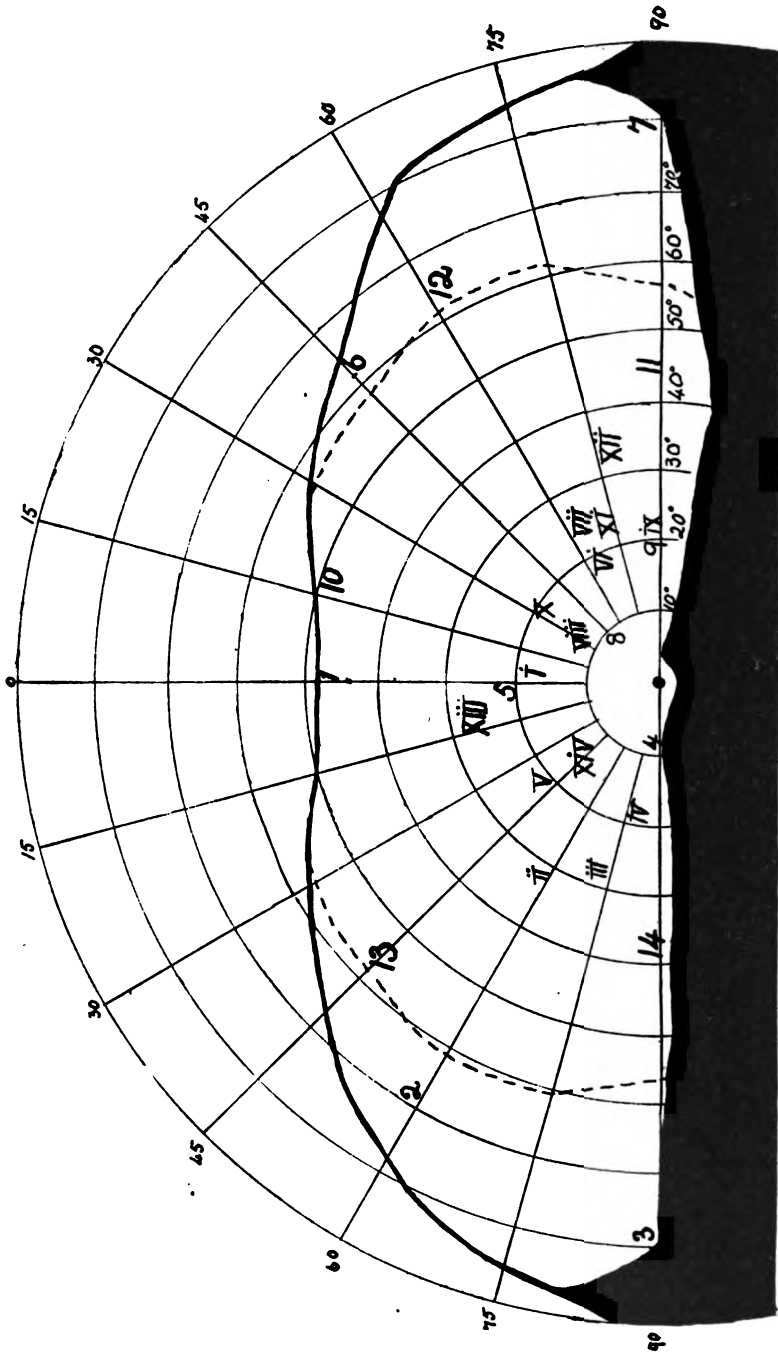


Fig. 3.—The binocular visual field to represent the false localization of objects seen by extramacular vision. The Arabic numerals indicate the true positions of the objects; the Roman figures the positions into which the patient projected them.

defective spatial guidance he received from vision and the accurate knowledge of space that contact gave him, was excellently illustrated when he attempted to take soup from a small bowl with a spoon; if he held the bowl in his own hand he always succeeded in placing the spoon accurately in it and in obtaining a spoonful of food, but when it was held by an observer or placed on a table in front of him he could rarely bring his spoon to it at once, but had to grope for it till he had located it by touch.

His defects in spatial localization by vision were equally obvious when he attempted to estimate the relative positions of two objects. When a silver and a copper coin were placed on a table he usually said both appeared the same distance from him, or if urged to decide, often described the one which was further away as the nearer one, and vice versa. Similarly, when a man in blue hospital uniform stood 7 yards and one in khaki 14 yards away, he described both as at the same distance; when the man in blue approached to 5 yards, he recognized that he was the nearer, but when later he moved 3 yards further away he was certain that they were at the same distance from him. "Everything seems practically the same distance from me," he remarked on one occasion. A yellow pencil was held up 30 cm. and a blue one 60 cm. from his eyes; he could form no idea of their relative positions, but he recognized it at once when he was allowed to touch them in succession with his hand. When the pencils were at such a distance apart that they made a wide angle with his eyes he explained, "They seem the same distance from me because I can see only one plainly at a time; I have to shift my eyes from one to get to the other," but this was certainly not the correct interpretation as he still failed to recognize their relative positions when one was almost behind the other, so that both were practically in central vision. If a screen was placed between his hand and any object he wished to reach, he invariably brought his hand against the screen even though he had seen it; he then became confused and evidently could not appreciate the spatial relations of the two objects.

His judgment of the distance from him of objects seen was repeatedly tested; it was as defective three and a half months after the infliction of the wound as during the first two weeks. On one occasion he estimated that a man 20 yards from him was 100 yards, while a chimney at least 150 yards distant he thought was only 50 yards away. A pencil was held up at various distances from him; when it was 24 inches he estimated it at 12 inches, when 5 feet he said 18 inches, and later did not recognize it had been moved when it had been brought to 8 inches from his face while his eyes were momentarily closed; when at 2 feet he said it was about 7 feet away. He underestimated or overestimated distances indiscriminately.

When, however, he was asked to place his hand at a certain specified distance from his face, or to indicate by his two hands the extension of ordinary standards of linear measurement, as an inch, a foot, or a yard, his replies were approximately correct. He could also indicate the lengths of familiar objects, as his rifle, bayonet, etc.

Appreciation of Length and Size.—If two lines of different length were drawn obliquely to one another so that their retinal images were not easily superimposed he could rarely distinguish their relative lengths even when the difference was considerable. Lines 5 cm. and 8 cm. long appeared to him equal, nor could he recognize that one was shorter than the other though they were 10 cm. and 15 cm., respectively. If, however, the lines were

parallel and close together he could generally distinguish, though not as readily as a normal person, their relative lengths. He also made gross errors in comparing the lengths of such objects, as two pencils, which were shown to him, though his replies were invariably correct when he touched them. In the early stages of his illness he was unable to recognize any difference in the sizes of such objects as a franc and a 50-centime piece, but three months later he could distinguish sizes more certainly, though not within the normal limits of discrimination. His attempts at dividing a line, or at finding the center of a circle, were generally very inaccurate, but he always seemed satisfied with his results.

Though he failed to distinguish any difference in the lengths of lines, even if it was as great as 50 per cent., he could always recognize whether a quadrilateral rectangular figure was a square or not. In one test when an oblong of which the pairs of opposite sides were 4.2 cm. and 4.5 cm., and a square of the same area were drawn on separate pieces of paper, his judgments as to whether both were true squares, and if not whether the one figure was the higher or broader, were invariably correct. He explained that in order to decide whether a figure was or was not a square he did not compare the lengths of its sides but "on the first glance I see the whole figure and know whether it is a square or not." When he decided that a figure was a square we could never convince him that it was not, or vice versa. Similarly he never confused a slightly elliptical figure with a circle. He could also appreciate to some extent the sizes of angles; a rhomboid even when its sides stood at almost right angles was always "a square shoved out of shape."

It is therefore obvious that though he could not compare or estimate linear extensions he preserved the faculty of appreciating the shape of bidimensional figures. It was on this that his ability to identify familiar objects depended.

Recognition of Movement.—When an object in central vision was moved at a slow and uniform rate he was often uncertain whether it approached toward or receded from him, but he always appreciated the movement and recognized its direction when it made an angle with his visual axes. This was demonstrated by a piece of simple mechanism; one end of a rod 50 cm. long was fixed to an axis that could be rotated by clockwork at an extremely slow and uniform rate, while its other end carried a small luminous point. The patient was placed in an absolutely dark room, so that he had no background against which to compare the movement; with his eyes at the point of rotation, and his gaze directed on the luminous point. He made a signal when he perceived the slightest movement and then described its direction. His replies were as prompt and as accurate as those of controls tested similarly. The smallest movement could be recognized also by peripheral vision, but unless its range was much greater than a normal person requires he made many errors in describing its direction. When, for instance, a piece of paper fixed on the end of a holder was brought from behind him into the periphery of his visual fields he was often unable to recognize whether it was moved up or down, backward or forward, or laterally unless its range was large. Even when the object was near his visual axes but outside macular vision, he was often uncertain of, or mistook, the direction of its movement if this were small.

The patient began to walk sixty days after he received his wound, and then many other interesting symptoms could be observed. From the first there was no obvious abnormality in his gait, but he progressed with

short, slow steps and his hands held out in front of him, like a man groping his way in the dark. When asked to go across the ward he invariably walked into any obstacle in his way, even though it was large and prominent and he had observed it before he started; he walked with considerable force into a wall, collided with a large red screen that stood in his path, and when asked to come to the observer he continued on his course till he had bumped heavily into him. When told to sit down on a chair some yards away he proceeded till he had knocked it over with his knees, but immediately on touching it he righted it and placed himself correctly in it. On colliding with such obstacles he showed great surprise and considerable discomfiture, and generally explained that he had not realized he was so near to them. The fact that he frequently stopped and searched with his hands toward objects still some yards from him is clear evidence that he also underestimated distances. Further, when he had run into a large obstacle, as a table or screen, he had considerable difficulty in getting around it; he could not understand how to circumvent it immediately unless he placed his hands on it and felt his way out of his difficulty.

These symptoms remained practically unchanged during the time he was under observation. Even if before starting he was made to describe and point out the obstacles in his path he still ran into them, though by experience he learned to grope continuously with his hands in front of him if he saw or suspected the presence of anything against which he might hurt himself.

He frequently failed, too, especially during the first weeks after he left bed, to walk in the correct direction toward any point he wished to reach. On one occasion, for instance, he was led a few yards from his bed and then told to return to it; after searching with his eyes for a few moments he identified the bed, but immediately started off in a wrong direction. Later he occasionally failed to take the straight course to a chair on which he wished to seat himself. Three months or so after the infliction of the wound this rarely occurred, provided he kept his eyes fixed on his aim, but immediately his eyes deviated from it he generally turned into a wrong direction and wandered aimlessly about till it had again come into central vision.

Some of the most interesting observations were made on a large flat roof that was divided by a wooden paling, about 4 feet high, with an open gate in it through which it was possible to pass from one into the other portion; there was a step about 1 foot high at this gate. Day after day he was brought to this roof and told to walk from one spot in its larger division, which will be referred to as A, to a point at the balustrade around the smaller portion, which we will call B. He always remembered that he had to pass through the gate and that there was a step there, but even after he had been repeatedly over this route he frequently set out in a wrong direction unless his eyes had been fixed on the gate; his course was often at right angles to the correct one, but as a rule he walked into the paling some distance from the gate and then guided himself to it by a hand which he kept on the paling, rather than by vision. When he had succeeded in passing through the gate he often took a wrong direction toward B, and reached it only by groping with his hands along the balustrade. When asked to return to the observer at A, he almost invariably ran into the paling again. He was never able to give even an approximately correct description of the way he had taken, or should take, to go from A to B, and though he passed along it several times day after day he never "learned his way" as a blind man would. When,

in fact, he was blindfolded he succeeded in finding his way about as well as when he had the aid of vision, and to one of us he seemed to walk with more confidence.

If after he had walked some distance he was questioned as to what he had passed he could recount the more prominent objects he had noticed, but could never give an accurate description of their spatial relations to one another. On one occasion he was taken to the edge of the roof and from there saw and recognized several objects, as two men in a boat about 500 yards away, the distinguishing features of an aeroplane at the same distance, and several ships. When his eyes were then covered he described these separate objects, but was quite unable to point to the direction in which he had seen them, or to say what their relations in space were to one another.

This and many other tests showed that he possessed good visual acuity, for he could see and recognize distant objects almost as well as persons with normal vision, but the associated sense impressions gave him no idea of the spatial relations of the individual objects, or of the topography of an area or surface that he had viewed; he could never evoke a memorial image of them.

Localization of Sound.—His power of localizing by sound was tested on several occasions. While he was still in bed he was asked to point in the direction of a sound made by striking two pieces of metal together, and this he seemed to do as accurately as a normal person can. When he was able to walk a more satisfactory experiment was made by blindfolding his eyes and making him approach from some distance one of several persons who called him; in this test he succeeded as well as controls who were similarly blindfolded. His ability to orientate sounds was, as his power of localizing by touch, intact.

Exploration of Surfaces.—Though after walking through the ward or around the large open space in which we frequently examined him the patient could generally say what he had passed, he certainly failed frequently to take cognizance of prominent objects which would scarcely have escaped the notice of an equally intelligent person with normal vision. This was especially so if his attention were focussed on one thing. When, for instance, he was asked to walk across the flat roof toward a tall chimney in the distance he kept his eyes steadily fixed on this and passed—without perceiving them—men, etc., standing along his course. The nature of this phenomenon was investigated by asking him to count a number of similar coins laid on a table, directing in the first place his eyes in such a manner that the images of all fell on the seeing portion of his retinae. He was extremely slow in this test; he generally stared fixedly for a time at one and then moved his eyes about the surface irregularly and unmethodically without making a systematic attempt to explore the whole. When four or five coins were placed irregularly he generally failed to see them all, frequently included one or more a second time in his count, and eventually became so confused that he gave up the attempt. That this was due to his inability to form a clear picture or idea of the spatial relations of those he perceived was made probable by his own explanation, "I seem to lose myself when I look from one to the other," and by the fact that when the coins were placed closely in a horizontal or vertical row he counted them promptly and without difficulty.

His horizontal hemianopia cannot be held responsible for this symptom, as it was frequently the coins furthest from him, the images of which fell on the seeing portions of his retinae, that he failed to perceive. One factor

was that objects outside central vision did not excite attention readily when this was claimed by another visual impression, but it was possible to attract attention to them, for he always perceived each coin and turned his eyes to it, when a pencil was moved above or around it. Another cause was the absence of any tendency to explore even a limited space by sight; he seemed satisfied with that small portion of space included in his central vision, and ignorant or unconcerned with its extension unless some object in it claimed his attention strongly.

Reading.—These disturbances help us to understand his difficulty in reading. When at first he was given large type (Jaeger 14) he read out with hesitation one or two words only, and gave the impression to the observer that his sight was not sufficiently good to allow him to distinguish the print; yet he immediately recognized words in the smallest type (Jaeger 1) quite as easily. Further, he rarely read words in their proper sequence but picked them out at random from the paragraph, and recognized long and unfamiliar words as readily as short or common ones, if his eyes happened to fall on them. When, however, only one word was presented to him he always read it promptly no matter what size the print was, though if shown the whole paragraph he appeared confused and frequently did not for a time identify a single word in it. His slowness in obtaining proper fixation and in moving his eyes over words in their proper sequence was certainly one factor, but his inability to recognize or picture to himself their spatial relations on the page was the chief cause of his apparent confusion; as he said himself, "When I move my eyes from a word I cannot get back to the right place." Later, when he became able to read a few words in sequence he could rarely bring his eyes to the left of the succeeding line—"That's where I'm done, I can't get my eyes down to the next line."

He always understood fully every word and phrase which he read. He wrote without mistakes but his letters to his wife were scarcely decipherable, as the words, though correctly written, were placed irregularly on the page, and the lines were often scrawled obliquely across one another.

Stereoscopic Vision.—It became obvious early in the course of his illness that the patient could not see tridimensional objects in perspective or appreciate depth in them, and this remained unaltered during the time he was under our observation. When, for instance, shown a cardboard box 18 cm. square and 8 cm. deep he described it as a piece of flat cardboard no matter at what angle he saw it, and was surprised when it was placed in his hands to discover it was a box. When its sides were folded down the only difference he noticed was the presence of "lines" which were not there when it was open. Similarly, he could not distinguish between a complete match-box and the broader side of a similar one which was cut off with half of the striking surface attached and bent into the same plane. A glass tumbler appeared "a piece of flat glass" the shape of which varied according as it was presented to him, and he described his impression of a man who stood in front of him by the words, "I can only see the front of him, I do not notice that he is thick; I cannot tell the depth of anything." He was so objective and honest as a witness that we had no difficulty in ascertaining the nature of his visual perceptions, even of objects which he knew were tridimensional.

He recognized no difference between a book which was fully open and one half closed with its pages at right angles to one another. On one occasion when standing beside a table with his hand on it he remarked spon-

taneously, "I would not know that this is a table by looking down at it; it seems to my eyes to be at just the same level as the floor I am standing on, but when I see its legs and its edges I know it is a table." He spoke frequently of "angles" and "edges," and explained that it was by means of these that he recognized the nature of objects which he saw; "I seem to be able to spot everything that is edged."

While standing in front of a flight of stairs he saw only "a number of straight lines on the floor," and when his eyes were fixed on the ground he failed to recognize steps and differences in level, though by experience he learned to associate shadows and differences in color on the floor with the idea of obstacles over which he might trip and depressions into which he might fall. Houses built on the side of a sloping cliff, one above the other, appeared to be the same distance from him and constructed on top of each other. Drawings and photographs which when fixed in a stereoscope appeared as tridimensional figures to normal persons, as a rule seemed to him flat when viewed in this instrument, though he occasionally described them as figures seen in perspective; but as this occurred even when he used only one eye it was more probably due to the association of a flat image with the idea of the object represented than to stereoscopic vision.

If he was asked to say whether a book held up in front of him was or was not at right angles to his line of vision he frequently replied correctly, but then explained that he knew it was oblique only because he could see its edge. When a sheet of paper was substituted he could never form an idea whether it was held obliquely to him or not; if almost parallel to his visual axes it was "a small piece of paper," and when vertical to them "much longer."

Final Result.—The latest information we have received of this patient was by a letter written on Sept. 30, 1918, that is, four and a half months after he had been wounded; in it he stated, "my sight seems to be quite at a standstill, I'm afraid." When he passed from under our observation most of his symptoms had remained practically unaltered for several weeks and seemed to be more or less permanent.

COMMENT

Our observations on this patient can be now briefly summarized. His chief symptom was inability to orientate accurately in space objects perceived by either central or extra-central vision, and especially to recognize the absolute and relative distances of things seen, though by touch and sound he localized sensible objects as readily as normal persons. His power of distinguishing and comparing lengths and sizes was similarly affected. Stereoscopic vision was abolished; he was unable to see tridimensional objects in perspective and to recognize depth in anything. These symptoms disturbed the performance of various actions in which he relied on sight for guidance.

He also presented a severe disturbance of visual attention, which made him unable to perceive readily or at all objects outside macular vision when his attention was held by that on which his eyes were fixed, and a failure to explore space spontaneously with his eyes; yet objects which threw even large images in his retinae were generally

perceived whole. Further, he was unable to evoke topographical memories acquired in the past and to learn his way in new surroundings. Finally, he had various anomalies of the ocular movements and reflexes, as failure to fixate promptly objects seen, to accommodate near objects, and to blink reflexly to threatening gestures.

His visual fields were reduced by blindness of both lower quadrants, but the acuity of central vision was good. The absence of aphasia and of serious mental deterioration, his intact faculties of motion and sensation, and the fact that he was an exceptionally reliable and objective witness, made it possible to carry out many tests and observations on the nature of the special symptoms he presented.

Certain of these deserve further consideration as they throw light on the cerebral processes which are normally concerned in spatial orientation and in the synthesis of the simpler visual impressions into that physiological product which is the basis of our recognition of, and reaction to, visible objects of the external world.

VISUAL ATTENTION

The disturbances we have interpreted as a local and special affection of attention may be first considered shortly as they do not form an essential part of that complex of symptoms which is of greatest interest in our case, and often occurs apart from and independently of it.

Repeated examination with small objects showed that in the whole of the upper quadrants of his visual fields retinal sensibility to both white and colors was intact; our frequent examinations with the perimeter and with Bjerrum's screen placed this beyond doubt; he could also distinguish familiar objects by peripheral vision. But while his eyes were fixed on anything, he noticed at the most only one other image that fell in the seeing portions of his retinas; when he gazed at the observer's face he could perceive a hand moved on either his right or his left side, but never the simultaneous movement of two hands. Even when he held up his own hands, one on each side of his visual axes, he could see only one, but indiscriminately that to this right or left. If the objects he looked at were small and fixation required attention he occasionally failed, as long as his eyes remained accurately fixed on it, to recognize another object even if near the fixation point. His failure to explore surfaces presented to him, or identify objects on them, and his obvious lack of interest in space outside his central vision were related to this symptom. As he lay in bed or sat in the ward he rarely moved his eyes or exhibited any interest in what was happening around him unless his attention was claimed by sounds, but he always evinced an intelligent interest in all that came into his

macular vision by accident or design. Similarly, on walking he passed unnoticed or collided with prominent objects, though their images fell in seeing portions of his retinas.

This condition has been recognized by several authors and has been recently dealt with by one of us; it is not uncommon as a unilateral phenomenon when lesions involve the cortex of the posterior parietal convolutions. It is essentially a disturbance of visual attention; retinal impressions no longer attract notice with normal facility, and if two or more images claim attention this is liable to concern itself exclusively with, and to be absorbed in, that which is at the moment in macular vision, since such images are naturally more accessible to consciousness than those that fall on the periphery of the retinae. Or, as is more common, when an object in central vision has attracted attention consciousness can take cognizance of one only of a series of other retinal images no matter how conspicuous or insistent they may be. There is, consequently, a restriction of attention, and the feeble call that objects outside macular vision can make on it explain its lack of spontaneity and mobility, and the little tendency it exhibits to direct itself to other visible objects.

Despite the failure of extramacular images to attract attention he generally saw even large objects whole, provided that part of them did not fall on the blind portions of his retinas; this is due to the rule that the mind when possible takes cognizance of unities, unless some detail in them excites special interest. In one experiment, for instance, the patient always recognized a large square drawn on a sheet of paper, but occasionally failed to perceive the whole of it when a prominent mark made in its center arrested his attention.

Head and Holmes have described an analogous disturbance of "tactile attention" when cutaneous sensibility is affected by parietal lesions. Though there may be no actual loss of sensibility or raising of the threshold only a certain proportion of tactile stimuli applied to the skin is then appreciated, and this proportion bears no relation to intensity of the stimulus provided it remains purely tactile.

SPATIAL ORIENTATION

It is unnecessary to refer again to the numerous observations which showed that the power of localizing accurately in space objects which he saw was seriously disturbed. This symptom was certainly not dependent on the large defect in his visual fields, or on a diminution of his visual acuity, for in the first place he always saw distinctly and recognized the test objects, and in the second, we have seen a large number of men with more or less similar defects in the visual fields who exhibited no evidence of affection of spatial orientation. Some

influence might be attributed to the abnormalities of the movements of his eyes, but it will be shown later that these were an effect and not the cause.

It is evident from our observations that our patient was unable to recognize the actual position of an object in any of three planes of space, that is, its location in the plane at right angles to his visual axes as well as its distance from him. It was, however, only during the first few weeks that he made gross lateral and vertical errors in orientating objects in central vision, though in this he never became quite accurate; but, as Figure 3 shows, he could never point to an object perceived by extramacular vision only. Localization in this plane of space depends mainly on the local signs of the retinal elements that are stimulated; by virtue of these we arrange our visual perceptions according to the arrangements of the excited retinal points, and by this means determine the relation in space of the object seen to the fixation point, and the relative positions in this plane of any two visible objects. Central lesions which affect the local sign function of cutaneous sensibility produce a very similar condition; the locality of a tactile stimulus on the surface of our body can be no longer recognized, though there may be no affection of the threshold of sensibility, or of the quality of the sensation evoked.

An intact local sign system can, however, assure only the correct recognition of relative spatial relations, and relying on it alone we cannot determine the absolute location of objects in space in relation to self. For this we need information on the position of our eyes, the attitude of our heads and the orientation of our bodies in space; only when given these can we form correct judgments on the positions of objects in central vision. Even this faculty was temporarily affected in our patient and probably never became normally acute.

The inability to recognize lengths and sizes and to compare the dimensions of two similar objects also resulted from disturbance of local sign function, as this made the patient unable to estimate correctly the magnitudes of the images that objects threw on his retinae. This judgment was further complicated by his inability to estimate distances, since the magnitude of the retinal image stands in an inverse relation to the distance of the object, but his failure to compare the lengths and sizes of lines and drawings on a sheet of paper proves that the loss of distance perception was not the only cause. Another contributing factor was his difficulty in transferring his attention quickly from one object to another, and in bringing them promptly in succession into central vision; this alone rendered comparison difficult and inaccurate, but it was obvious that this factor had not the importance which the patient himself attributed to it.

It is interesting that he preserved the idea of size and extension, and could indicate approximately the lengths of conventional standards, as a yard, foot, etc., and show the sizes of such familiar objects, as his rifle and bayonet.

His power of recognizing promptly the shape of simple geometrical figures demonstrates that in this we do not naturally depend on the comparison of lines and angles, but that we apprehend shapes as a whole and accept them as unities; only when questions and doubts arise do we resort to deliberate comparison and measurement. Similarly, though when asked to read he frequently paused some seconds before identifying a single letter, he never spelt these out one by one, but recognized the words as totals.

The perception of both absolute and relative distance was, as is the rule in such cases, much more severely affected. Our observations make it evident that his errors in estimating the distance from himself of objects in central vision were very gross, and that even when one was twice as far from him as the other he could not distinguish the relative distances of two objects. His own statement that everything appeared at the same distance from him emphasizes this defect better than any description can.

The nature of this symptom can be understood only when we consider the processes on which the estimation of distances normally depends. This, as Berkeley originally pointed out, is not a simple visual sensation or an innate quality of retinal impressions, but must be an intellectual operation based largely on nonvisual experience, as on the testing and controlling of visual perceptions by tactile and muscular sensations from all parts of the body. Even in adult life we judge distance only by indirect means; by the effort of accommodation and convergence when the object is sufficiently near for these to come into play; by the apparent size when the real magnitude is known; by the difference between the retinal images that the object forms in the two eyes; by the parallax obtained on either movement of the object or of ourselves, and by various empirical data, as clearness, light intensity, etc. Our patient's symptoms cannot be attributed to loss of any one of these elementary physiological factors. It is true that he did not accommodate or converge properly, but as he succeeded in this when he was aware of the distance of the object from him it was obviously an effect rather than the cause; his inability to judge apparent size may have contributed but could not have been the sole reason of such a gross disturbance; while his central vision was sufficiently good to allow him to perceive such qualities as clearness and light intensity, and by central vision he could appreciate the smallest lateral movement.

The cause of his inability to estimate distance must be sought rather in his failure to correlate and assimilate with past experiences those apparent impressions on which perception in the third dimension may be based, and consequently to supply to consciousness the data on which a correct intellectual judgment can be made.

His disturbances of spatial localization were limited to those which depend wholly on visual impressions; he orientated himself and external objects by touch and recognized the origin of sounds quite as accurately as normal persons.

APPRECIATION OF MOVEMENT

The slightest lateral or vertical movement of a visible object could be perceived and attracted attention whether seen by macular or peripheral vision, unless its displacement were directly toward or from him; then he often failed to observe its motion, or could not determine whether it approached or receded. But when its image passed in succession over a series of retinal points it immediately aroused a sensation of movement. Even then the direction of the movement was recognized by extramacular vision only when its range was considerably greater than the normal person requires; the simple retinal faculty of perception of movement was preserved, but the appreciation of the spatial relations of the retinal points excited was affected.

VISUAL MEMORY

Another interesting group of symptoms was due to a special affection of his visual memory. His recollection of the ordinary events of the day and of his past was certainly good; he spoke without hesitation of what had occurred during previous examinations and in the periods between them, and related events of his past life as coherently and intelligently as could be expected from a man of his education. But he could never give us any idea of how he would go from the house in which he had lived for years to the railway station of his town, or to his workshop, which he could only say was close by. "I have no clear picture of it," he complained, "I used to be able to see the way, but I can't see it now."

Further, he did not succeed in learning his way about even when his path was simple; he would often set out in a wrong direction though he had been time after time over the same route, and when asked to return along it, failed to utilize his immediately previous experiences; unlike a blind man he seemed to acquire or retain no memory or picture of the route he had passed along. His inability to determine accurately the spatial relations of objects seen, his tendency to neglect visual impressions that did not attract attention strongly,

and his difficulty in bringing objects quickly into central vision, must have all contributed to his failure to form or retain a distinct idea or memory of his path, but in this he was so much inferior to the blind man, or to a person temporarily deprived of sight by blindfolding, that a further explanation must be sought.

The fact that he did not retain any memory of routes and topographical relations that were familiar to him before he received his injury and could no longer recall them, suggests that the cerebral mechanisms concerned with spatial memory, as well as those that subserve the perception of spatial relations, must have been involved. And as it is predominantly from visual impressions that we form our idea of space, a disturbance in the functions of this mechanism made him, unlike the blind man, unable to utilize or profit by the knowledge of space that he would have otherwise acquired from tactile, muscular and other sensations.

This was probably not a pure isolated loss; to such tests as we employed he seemed to retain simple visual impressions less well than the average normal person, or than he himself retained words spoken to him. The paths and centers which are the physiological basis of visual memory were affected, but it was chiefly those that subserve the retention and recollection of spatial relations that suffered.

STEREOSCOPIC VISION

Stereoscopic vision, or the power of recognizing depth and thickness in solid objects, was completely lost in our patient. Everything appeared to him flat and bidimensional; he identified familiar things only by associating their areal shape with previously acquired experiences, just as the normal person interprets flat drawings as the objects they represent.

This symptom might be regarded as a natural consequence of his inability to appreciate relative distances, since, it might be argued, he could not therefore discriminate the different depths of various portions of a tridimensional figure. But as stereoscopic vision was not affected in any of Holmes' six cases or in other similar ones which have been recorded, although the appreciation of distance was severely disturbed, it is obvious that loss of distance perception does not necessarily abolish it, though it must be a contributing cause. Neither are the muscle changes associated with convergence and accommodation, which make possible the focusing and exploration of the depth of an object, an essential factor, as the patients just referred to possessed stereoscopic vision, though they were unable to accommodate external objects accurately; and as our patient recognized differences in light and shade it is evident that it is not on this alone that stereoscopic vision depends.

These may be all contributing factors, but the essential basis of seeing in relief or perspective is the fusion of the two noncorresponding images that a solid object forms in the two eyes into a single visual concept; like space perception it depends therefore on a higher process in the hierarchy of our cerebral activities than do sensations and simple perceptions. Our patient received such noncorresponding images in his two eyes, and in this sense he had binocular vision, but owing to the cerebral lesion these, when transmitted to the cortex, failed to be properly fused and assimilated with other visible qualities of the images, into a single concept that could give him the idea and power of discrimination of depth in the object seen.

OCULOMOTOR SYMPTOMS

The remaining symptoms presented by our patient were due to a disturbance of the motor and reflex functions of the eyes. There was no palsy of any of the ocular muscles, and he never had diplopia, but, especially during the first part of his illness, he had difficulty in fixing accurately and in bringing promptly into central vision objects which he saw, and in keeping his eyes fixed on a moving point. Further, when anything at which he looked was approached toward his face his eyes failed to converge, he did not accommodate, and his pupils did not contract; he could consequently see nothing distinctly that was within 25 cm. of his eyes.

All these symptoms were secondary to and dependent on the loss of spatial orientation by vision, for they disappeared when he was aware of the position in space of the object which he should fix or accommodate. He turned his eyes promptly and accurately to any point on his own body that was touched, and when his own finger was moved passively toward his face his eyes converged and accommodated on it naturally. There is evidence, however, that this affection of fixation and accommodation is not always directly dependent on loss of spatial orientation; two of Holmes' patients, as well as two similar cases published by Förster and Riddock, were unable to fix their own fingers or bring central vision promptly to points on their own bodies. In some of the recorded cases, too, convergence of the eyes, accommodation and contraction of the pupils did not supervene when the patients attempted to keep their own fingers in distinct vision as they were moved toward their eyes.

Finally our patient failed to react by blinking or withdrawing his head when an object was jerked suddenly toward his face, or to any other threatening gesture. His own explanation that he could not recognize the nearness of the threatening object was probably correct,

as he invariably blinked if his own hand was swung passively toward his eyes, or if the movement of the external object produced an appreciable current of air. The abolition of the blinking reflex in this patient was consequently in all probability due to his loss of spatial perception.

ANATOMIC SITE OF THE LESION

It is not possible in the absence of an anatomical examination of the brain to determine accurately the site of the lesion produced by a gunshot wound of the head, the extent of the damage, or the centers and tracts that may be involved by it, but craniometric measurements enable us to form at least an approximate idea of the portions that are injured.

A necropsy was obtained in one of Holmes' patient, and from this and an analysis of the positions of the wounds in his other five cases and in those recorded by Inouye and Riddock—the only other instances at present known to us of similar conditions due to gunshot injuries—he concluded that this symptom complex appears only as a result of bilateral injuries, and when the lesions on the lateral surfaces of the hemispheres involve the angular gyri or their neighborhood. The fact that more or less similar symptoms have been produced by vascular lesions limited to these portions of the lateral surfaces of the hemispheres (Pick, Bálint, van Valkenburg) and by experimental destruction of this region in dogs and monkeys, by Munk, Schaefer and Ferrier, is evidence that damage of the cortex or subcortical tracts in the region of the angular gyri is the anatomical basis of the condition. The measurements of the positions of the wounds and of the cranial defects in our patient suggest that the missile entered through the posterior portion of the right angular gyrus and made its exit through the upper part of the corresponding gyrus of the left side. Its track consequently conforms closely to that in the other recorded cases in which gunshot injuries produced the same or similar symptoms. We cannot, however, ascertain more accurately the cortical areas and tracts that were involved.

The symptoms we have described cannot be, however, regarded as a direct result of the destruction of centers that subserve the spatial orientation of visual impressions and allied functions, since these functions are not purely sensational, but are the result of the mental synthesis of more elementary visual perceptions, with the afferent impressions derived from the proprioceptive organs of the ocular and neck muscles and from the labyrinths. They should be rather interpreted as the effect of an injury of association paths between those portions of the occipital cortex which are concerned in visual perception and the rest of the brain.

BIBLIOGRAPHY

1. Bálint: *Monatschr. f. Psychiat. u. Neurol.* **25**:51, 1909.
2. Förster: *Archiv. f. Ophth.* **36**:96, 1890.
3. Head and Holmes: *Brain, Lond.* **34**:102, 1912.
4. Holmes: *Brit. J. Ophthal.* **2**:449, 1918.
5. Inouye: "Die Sehstörungen bei Schussverletzungen der Korticalen Sehsphäre," Leipzig, 1909.
6. Pick: *Beitr. z. Pathologie u. Patholog. Anatomie des Centralnervensystems*, Berlin, 1898.
7. Riddock: *Brain, Lond.* **40**:15, 1917.
8. Van Valkenburg: *Deutsch. Ztschr. f. Nervenhe.* **34**:322, 1908.

A PROBABLE ETIOLOGIC FACTOR IN MULTIPLE SCLEROSIS *

MALCOLM S. WOODBURY, M.D.

CLIFTON SPRINGS, N. Y.

The basis of this paper rests on the observation of six cases of multiple sclerosis. All of the six were symptomatically typical. Two were relatively early, the others were more advanced. Spasticity of both legs and bilateral Babinski sign were present in all; abdominal reflexes were uniformly absent; all, except one early case, showed pallor of the temporal half of each disk; nystagmus and intention tremor were present in all. All had complained of bladder irritability which had appeared early in each instance; incoordination of upper as well as lower extremities was present in all. Sensory symptoms were practically absent. As a discussion of symptomatology is not intended, transcript of case histories is omitted as the symptoms common to all the cases seem to furnish sufficient positive evidence, and negative blood serum and cerebrospinal serologic findings and the clinical progress, insufficient negative evidence to establish the diagnoses fairly clearly without detailed description of the individual cases.

ETIOLOGY

Multiple sclerosis is a disease of youth, or young adult life, infrequently first appearing after the age of 45. The average age of onset in our cases was 36; a rather high average, as one case was 54 at time of onset.

As possible causative agents, acute infectious diseases have been noted, such as typhoid, smallpox, scarlatina, influenza, whooping cough, acute articular rheumatism, etc. The condition is also said to have developed after the puerperium. Chill, metallic poisoning, carbon monoxid poisoning, alcoholism, injury and violent emotion have all been accorded more or less emphasis. Oppenheim says that in about 50 per cent. of the cases, no cause is evident. In a recent statement Crafts¹ says:

Close analysis of the commonly attributed etiologic factors . . . must lead to the conclusion that the real cause or causes are as yet really entirely unknown. In what manner can previous acute infectious diseases, such as

* Read before the Rochester Medical Society, Rochester, N. Y., Jan. 6, 1919.

1. Crafts, L. M.: The Early Recognition of Multiple Sclerosis, J. A. M. A. 69:1130 (Oct. 6) 1917.

typhoid fever or pneumonia, traumatism, exposure or the puerperium act to initiate the development of succeeding foci of gliosis scattered with entire abandon throughout the sphere of the central nervous system, occurring, receding, with apparent clinical recovery, latent perhaps for years, again and again recurring, and receding throughout a course of great chronicity? In what manner is it possible for these long past incidents to so affect the organism as to cause the repeated turning into the blood stream of some genetic agent, probably autotoxic in nature, to attack here and there limited patches of white or gray matter, destroying the myelin sheaths, leaving the naked axis cylinder and the cells largely intact and functioning, although suffering to some extent degenerative effects?

In referring to a possible infectious origin practically all writers appear to refer to the occurrence of an acute infectious disease in the past rather than to the continued action of a long existing source of infection, though an occasional hint that such a possible source should receive more consideration has appeared in the discussion of certain recent papers.

With regard to etiology, it is practically impossible at present to study this condition satisfactorily from the experimental viewpoint, because of the fact of the very slow progress of the disease suggesting as it does, not the result of an acutely active process, but the result of some agent exerting a prolonged gradual influence interrupted by periods of exacerbation and remission. The chief evidence at present must be gathered from controlled clinical observation and tissue study. The former method was directly possible on only four of our patients as two were unwilling to pursue the plan recommended. The six patients had had the more usual diseases of childhood, but there was no outstanding evidence of probable causal relationship apparent from any of the histories.

These patients were studied primarily without reference to any theory of etiology, and as they were admitted over a period of five years, it was not until several of them had been under observation that we had sufficient data to offer a likely etiologic lead. The only possible etiological condition regionally common to all was some type of inflammatory disease of the upper respiratory tract. Such a coincidence might, however, occur very easily in any consecutive small number of cases in view of the prevalence of such conditions. That every one of the six patients had obviously chronically infected tonsils seems to be worthy of note. This was the one pathological feature in addition to the disease of the nervous system which was common to all, and the only one which seemed to us to give any definite inkling of etiology except that five of the patients had also—as dentograms revealed—peridental infection. This, however, was not strikingly extensive, either in the number of teeth involved or the degree of involvement. No dental observations were made on the other case.

In our opinion no tonsil is properly observed until a clear view has been obtained of all its free surfaces and firm pressure has been applied in an attempt to express free pus. Abscesses may in many instances be ruptured by pressure with the spatula tip, and tonsils showing vascular engorgement, adhesions, or exudative plastic covering ought to be carefully examined.

PATHOLOGY

In reference to the pathology of multiple sclerosis, Schlesinger says, in part:

In the foci one finds upon microscopic examinations no, or only a few, nerve fibers retaining their medullary sheath. But many well-preserved axis cylinders pass through the foci. The neuroglial tissue is extraordinarily increased, and forms a thick felt-like layer, which does not show any tendency to softening anywhere. The ganglion cells, even in the center of the foci, are not injured, but the vessels often show grave changes; their walls are thickened and the lumen narrowed, or even entirely obliterated. Secondary degenerations are absent, even after long continuation of the disease, and with numerous foci. Upon the advent of diffuse sclerosis, changes in the form of the sections attacked, especially in the pons, occasionally occur.

Besides the old foci, one frequently sees diseased spots in which the process is of more recent date; small-celled infiltration of the vessels is exhibited.

Orr and Rows,² as a result of their experimental work, sharply distinguish the pathological types resulting from different routes of infection in the central nervous system. They first recall the fact that there are but two ways of producing inflammatory changes in this system. The one is by way of the lymphatics, the other through the blood stream. Toxic or microbic invasion by way of the lymph pathways produces a primary inflammation of the fixed tissues, whereas infection of the brain or cord by way of the blood stream produces a totally different picture, showing remarkably little evidence of inflammatory changes in the fixed tissues, the areas of degeneration of medullated fibers apparently being associated with vascular changes. They further state that nonsystemic lesions occurring in the spinal cord are characterized by atrophy of the myelin sheath and sclerosis, and appear to be dependent on some toxic condition of the blood stream. They did no work with multiple sclerosis, but their conclusions are of obvious significance in this relation.

None of our patients have died and I can obviously give no necropsy record of them. I have, however, been much interested in the study of some sections from a case of multiple sclerosis. These sections were prepared in the neuro-pathologic laboratory of the

2. Orr and Rows: *The Interdependence of the Sympathetic and Central Nervous Systems*, Brain, Lond. 41: Part 1 (June) 1918.

Charité in Berlin. Dr. S. T. Nicholson has kindly made careful observations and camera lucida drawings to scale from these sections, giving special attention to the vascular and perivascular conditions. The rest of the sections correspond in general with the pathologic description already quoted. Dr. Nicholson's report is as follows:

Description (General) of Vascular Condition in Area of Sclerosis from Slide of Multiple Sclerosis.—1. Blood vessel walls are thickened with lumen constricted.

2. Vessels are infiltrated with small round cells in the adventitia.

3. Organization of inflammatory infiltration almost obstructing the lumen of certain of the larger vessels (compare illustrations).

4. Necrotic (acid-staining) areas in perivascular region which according to Schlesinger are fatty granular cells filling the adventitial lymph spaces.

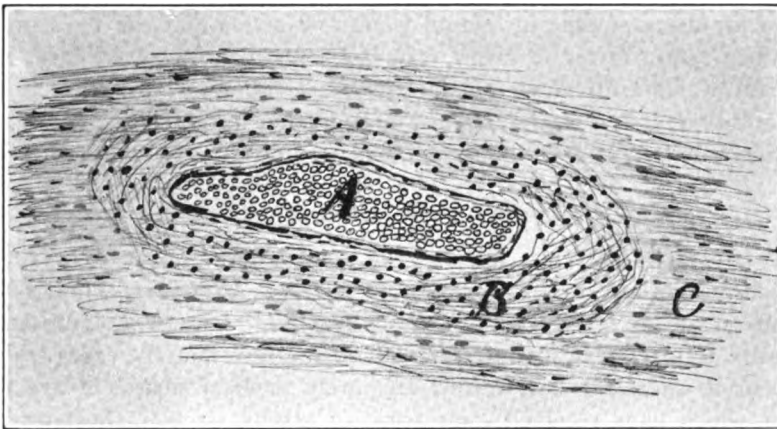


Fig. 1.—A, lumen of vein filled with red blood cells; B, circumscribed area of infiltration around vein, consisting of round cell infiltration and very early fibrous tissue; C, sclerotic tissue.

COMMENT

It seems evident that the lesion in certain cases of multiple sclerosis is at least in part inflammatory, and that the type is very strongly suggestive of a process spreading by way of the blood vessels, and that a very essential element in the picture is the pathology of the vessels themselves. The wide irregular distribution of the lesions would certainly point to a probable origin by way of the blood stream.

We have then a small series of cases all showing ample preoperative and postoperative evidence of tonsillar infection. We have further a probable common general pathology in the central nervous system which is perhaps dependent on some type of poison in the circulating blood. This evidence is certainly far from positively conclusive,

especially as we have isolated no organism not common to other tonsillar infections; but it is as far as we can go at present except as the progress of the cases is of significance.

Four of these patients had their tonsils removed; the other two refused. Of the four, all had later, or are having their dental work attended to. Reports have been received from all. Two relatively early cases report themselves as "well," despite the fact that both had previously been greatly hampered by motor incapacity and bladder trouble; one of these developed infected antra after the extraction of peri-abscessed teeth, but reports a favorable convalescence. One begins her last report, a year after we saw her, as follows: "Perhaps you remember Mrs. N. I am she in name, but in no other way, for I am just as well as I never hoped to be," etc. In one rather advanced case, four months after observation, the patient is walking without a cane for the first time in several years and states that she feels more "limber" and "better in every way." In another advanced case, the patient walks with much greater ease, one and one-half years after observation; is less easily fatigued, and pursues his work in the lumber business daily. These four are all leading active, useful lives.

USUAL RESULTS FROM MEDICAL TREATMENT

I am well aware of the striking remissions and apparent cures which may occur in cases of multiple sclerosis, with or without treatment. I incline to the view, however, that there may be a significance relative to a possible infectious origin in the fact that the cases which appear to show the best record on purely medical treatment are the ones which have received some form of arsenic or the salicylates, or both.

RECENT LITERATURE

At a meeting of the Chicago Neurological Society in January, 1917, Dr. James C. Gill reported a case of multiple sclerosis, in which the diagnosis was concurred in by Dr. Peter Bassoe. This patient showed apparent recovery after the elimination of peridental and tonsillar infection and was evidently reported to emphasize a possible infectious etiology.

The recent painstaking pathologic studies by Klingman,³ and the illuminating paper by Spiller⁴ appeared subsequent to the preparation of this paper. Both these communications lend weight to the histogenetic theory of multiple sclerosis, but Spiller clearly admits and

3. Klingman, Theophile: The Histogenesis of Multiple Sclerosis, *Arch. Neurol. & Psych.* 1:39 and 193 (Jan. and Feb.) 1919.

4. Spiller, W. G.: The Subacute Form of Multiple Sclerosis, *Arch. Neurol. & Psych.* 1:219 (Feb.) 1919.

seems to favor the theory of a possible secondary infectious element of some type, perhaps syphilitic, in certain instances. Klingman's paper, while strengthening the evidence of histogenesis, does not appear conclusively to eliminate a coincident inflammatory process. One questions whether certain cellular elements which he covers by description may not actually furnish evidence of small round cell infiltration.

CONCLUSION

I would say in conclusion that certain of the pathologic evidences taken in conjunction with the uniformity of certain of the clinical observations and the apparent results of treatment in these few cases would seem, in consideration of the otherwise indefinite state of our knowledge regarding the etiology of multiple sclerosis, to warrant laying some stress on the desirability of clearing up whatever areas of infection can, on careful study, be discovered. The theory of a possible localized infective source, distributing its toxic products through the circulation furnishes an hypothesis which would appear to meet the arguments on which Crafts, in the statement quoted, largely bases his contention that no etiologic explanation available appears adequately tenable.

EXPLANATION OF PLATE

Fig. 2.—*A*, adventitia; *B*, media; *C*, intima; *D*, vacuoles; *E*, early fibrous tissue (fibroblasts).

Fig. 3.—Arteriole filled with red blood cells with areas of round cell infiltration adjacent to vessel wall (chronic inflammatory process). From slide of multiple sclerosis.

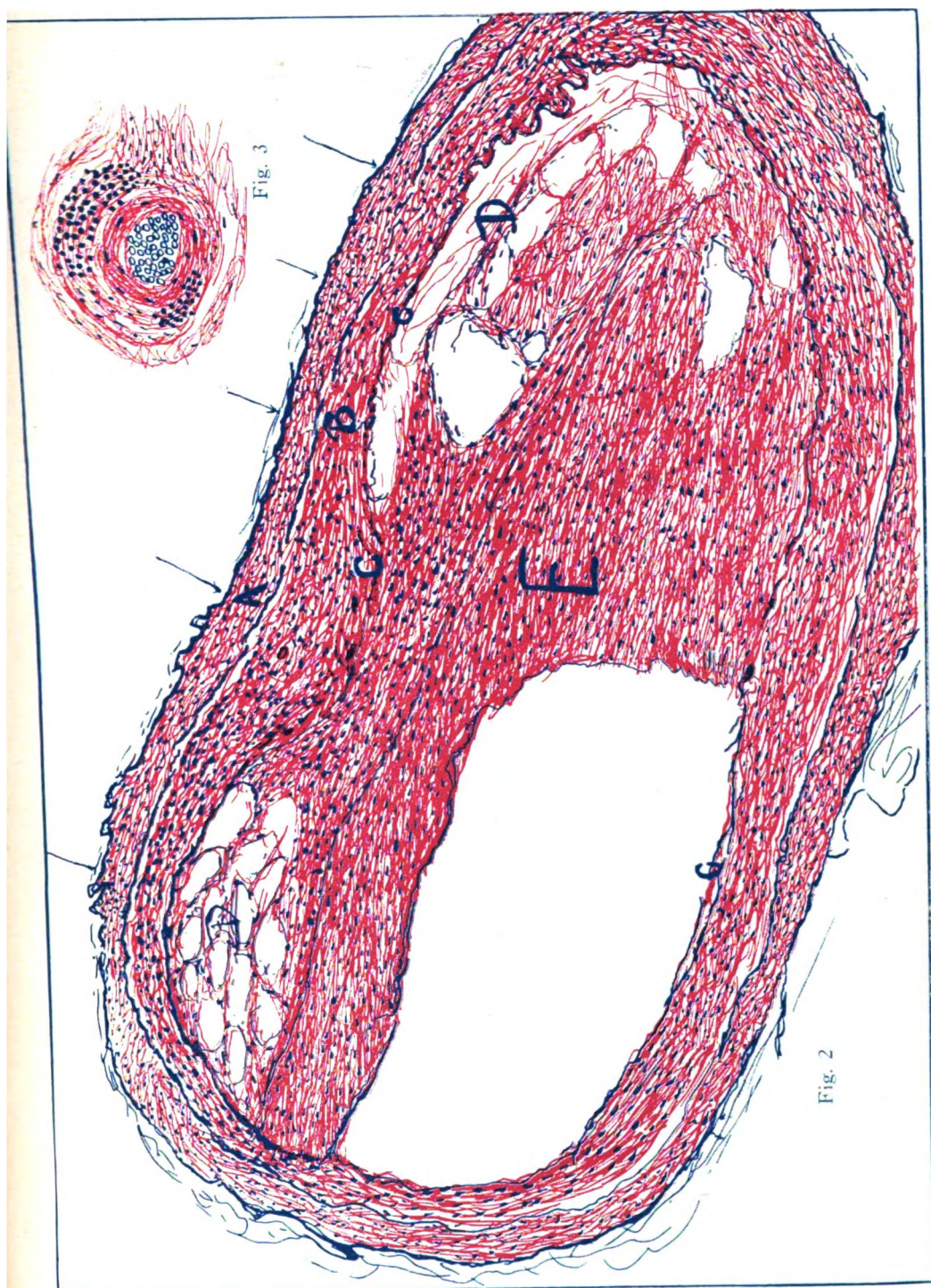


Fig. 3

Fig. 2

A CLINICAL STUDY OF PSYCHOSES CHARACTERIZED BY DISTRESSED PERPLEXITY *

AUGUST HOCH, M.D., AND GEORGE H. KIRBY, M.D.

MONTECITO, CALIF.

NEW YORK

In this article it is our desire to put together seven cases which presented as the most prominent symptom a more or less pronounced perplexity associated with distress, and we hope to demonstrate that these cases represent a definite reaction type.

The observations were made in part at the McLean Hospital, Waverley, Mass., by Dr. Hoch; but the greater part are cases which were studied at the Psychiatric Institute, the observations before 1910 having been made by Dr. Kirby, the later ones by Dr. Hoch or under his direction.

We shall first give a description of the cases. Since it is impossible for want of space to give them in full, we shall present abstracts, in the preparation of which great care has been taken so that a concise and yet complete picture of each case should be available.

CLINICAL MATERIAL

CASE 1.—Caroline J., aged 45, single, was admitted to McLean Hospital Nov. 28, 1900.

Family History.—One sister and one brother had depressions past middle life from which they recovered. The parents are said to have been normal, and all psychopathic tendencies are denied, even in collaterals, with the exception of a maternal uncle who was dissipated.

Personal History.—The patient is a well-educated woman who is said to have been rather unusually sensible and capable. She never had a former psychosis. No cause is known for the present attack, and since the patient menstruated regularly during her whole attack, there is no evidence of the menopause as yet. For some months before admission she was a little tired. For one month she slept poorly, had a poor appetite, and became physically run down. The real attack began only about two weeks before admission. After recovery the patient said it began rather suddenly with the feeling as if everything left her. The brother told us that she became very undecided and depressed, and worried over trifles.

Under Observation.—For about six weeks the patient was in a constant state of perplexed uneasiness, with considerable restlessness. This latter trait always remained within certain narrow limits, showing itself in her constantly moving her hands—pulling at her clothes, brushing herself, and also making meaningless motions with them. She spoke herself of “feeling all confused”—“I can’t tell anything about anything, I am so confused”—“I don’t feel straight”—“I can’t grasp things.” Although it was often possible to get her

*From the Psychiatric Institute of the New York State Hospitals.

to answer trivial questions readily enough, practically nothing was obtained, except the answers just given, whenever her worries were inquired into. She hesitated much, started and stopped without getting anywhere, or she said directly that she could not tell what she worried about; "I can't tell. I can't even tell how I feel—too many things." On another occasion she said, "I can't tell, it is too hazy." Indeed, even when she was better, she said she was unable to tell what she had worried about, because it was too vague, that she could not describe it, but she always denied that she was afraid at that time.

It was only in the very beginning of the observation that she told her nurse a few more definite things. Thus, she said that she felt it would ruin her sight if she had a movement of the bowels. Again, she thought her urine did not come out of the right place. A certain feeling of guilt was also expressed on the first day when she told the nurse not to touch her; "When an honest person touches me I feel as if I were not honest." Referring to the same period she said retrospectively that she could not go to the toilet at that time (she did resist in that respect), because she thought she had a miscarriage; and she also thought she had embezzled some money as treasurer of a mission. But she again added that the main worry was vague, and these more clearly formulated ideas were evidently not present later.

Whenever orientation questions were asked or when she was asked to perform certain intellectual operations, one met with statements such as that she did not know, that the days were mixed up. But it was invariably found that she was quite clearly oriented, and retrospectively she knew many details of what had happened around her. Her calculations were usually slow but correct.

When this perplexity faded, it gave way rather quickly to a simple depression. The patient herself later said, "It seems as if I lost my will power as I got quieter." From then on a prominent feature was a pronounced feeling of inadequacy; "I can't seem to make up my mind to act"—"I have great difficulty in doing things," etc. Another feature was a feeling of unreality of moderate degree: "Things don't seem quite real"—"After you are gone it won't seem that you have been here." She complained of her affection for her family being diminished; "My sister seems far off"—"I don't even feel hunger, heat or cold as I used to." She worried now entirely about her condition.

Four months after admission she was discharged almost recovered, and soon recovered completely.

CASE 2.—Mary D., aged 57, married, was admitted to McLean Hospital Feb. 21, 1903.

Family History.—Father had a "melancholia" in advanced years. One sister had a "nervous breakdown."

Personal History.—It is claimed the patient was of a normal disposition.

In connection with the menopause at the age of 47 she had a psychosis which lasted six months. It began suddenly with the idea that she was to be carried off. All that is known about the attack is that she was restless, paid little attention to her surroundings, and spoke at times of an electric battery in her. She made a perfect recovery.

Present Attack.—Three weeks before admission, after a fatiguing care of her sick husband, she is said to have had influenza. A few days later she became sleepless, worried about her husband, cried much, thought she was going to have various diseases. She spoke of hearing a telephone, became restless, said she wanted to die, was losing her mind and kept repeating,

"What shall I do?" At other times she is said to have been quieter, with some insight into the morbid nature of her ideas.

Under Observation.—For ten days the patient showed a marked perplexity. She was uneasy, restless, her facial expression showed bewilderment. This was also expressed in various utterances: "I am confused"—"I can't understand things"—"I am dreadfully mixed up"—"It is a mystery"—"What is the matter, am I silly, or am I crazy?"—"I don't know what to do"—"Will they take my mind away?" She also said her mind was weak and "I can't seem to remember." In addition to that she said, "Nothing looks natural"—"Everything looks alike." Then there was a peculiar feeling of reference: "Every little thing seems to have a meaning"—"Why do the nurses go out?" A vague feeling of guilt was expressed in the following: "Have I done wrong?"—"What do they mean by saying I stole money?" Again she said, "I have been wicked."

A few more peculiar ideas were expressed: "What do they mean by saying that I turn into two girls?" Or again, "They tell me that I have glass eyes all over."

As regards her orientation and intellectual operations, it may be said that she knew she was in McLean Hospital, but sometimes asked if it were not the X hospital. She knew the name of some physicians and in a general way the dates and how long she had been in the hospital. But she seemed unable to calculate or to give a good account of her life when this required an intellectual effort. She could not do correctly more than simple multiplications, was unable to take 7 from 100 consecutively, could not calculate the year of her birth in spite of knowing her age and the present year, could not give the date of her marriage or the birthdays of her children.

At the end of that time the patient became less perplexed but cried at times; said she was going to die. This condition was followed after a few days by a period in which she was often quite natural, at other times a little irritable, or again homesick, with considerable insistence on being allowed to go home, and now and then crying. Retrospectively the patient said that she felt confused at first, that nothing looked natural, everything looked alike and that for this reason she thought she could not see right. But a careful inquiry into her actual capacity of elaborating impressions at the time of her psychosis was not made.

She was discharged, recovered, March 26.

CASE 3.—Polly V., aged 37, married, was admitted to the Psychiatric Institute May 4, 1916.

Family History.—It is claimed the family history is negative with the exception of the fact that one brother had an attack of insanity from which he recovered.

Personal History.—The patient is a Jewess who was born in Prussian Poland, emigrated to England and later came to the United States when 25 years old. Her people are decidedly ignorant and it is difficult to get a very reliable account of her make-up; but she is said to have been rather quick tempered, lively, fond of amusements a good mother and a good wife. She was married when 20 and has six living children, the youngest 2 years old.

For several months before admission the patient was rather nervous, easily frightened and fearful about her children. Three months before admission a cousin and his wife came to live in the same house in which the patient was janitress. A few weeks before admission this cousin began to complain to the patient about his wife; when the latter heard this she came to the patient

(about a week before admission) and made quite a scene, during which she pulled the patient's hair, and it is claimed that the latter fainted. Moreover, this woman complained to the landlord that the patient was not taking proper care of the house, and she got several other women to turn against her as well. They now threatened to report her to the board of health and to the charities department for not keeping the house clean. They scared her also by telling her she would be sent to prison. This made the patient very nervous, but it is claimed that she got some comfort out of the landlord's writing to her that he would come and investigate the matter and if the complaints had no foundation he would send away the other women. When at the appointed time the landlord did not come, the women giped her and she was much upset and again fainted. This was only a few days before admission.

She was then sent to her brother's house. There she said she had to go to prison, to the electric chair; again, that she was going to die.

At the Observation Pavilion she is described as distressed, hearing her children, saying her children had been taken away from her.

Under Observation.—The patient for the first six weeks showed much anxiety, distress, and crying, often with more or less restlessness. At times she was somewhat absorbed when left to herself, and there was little occupation at any time. Occasionally the statement is made in the notes that she was a little bewildered, but this is rare and, in spite of the fact that many notes were made, is never substantiated by any definite statements on her part of a feeling of perplexity. All her utterances referred chiefly to her children and her anxiety about them: "Will I ever see my children again?"—"My children have been taken away." More frequently she spoke of them as having been killed: "Somebody killed my children; they do not need any mother any more"—"They killed my children. Did they deserve to be killed? They were good children." Or she claimed she had seen smoke and knew it meant that her children had been burned, or from the window she had seen them in the water. Again, when moaning or crying was heard in the ward, she often thought it was her children who were being killed. She was, however, not always fully convinced of this. Once she said, "If my children are dead, I don't want to live any more." Less often she feared that something had happened to her husband: "My husband is sick. Is my husband dead?"—"Is my husband not dead? I think he is in the water." And once when she spoke in this way about him, she added, "Is my mother killed too?" Twice she dreamed that her whole family was burned to death and was quite stirred up about it in the morning. At one time she said quite placidly, in strong contrast to the usual distress: "I won't live with my husband any more. I am going to send him to California. I don't want to have any more children." On the other hand, the ideas about her children were also formulated in a different way at times, namely, in the form of self-accusations or in the form of accusatory voices: "I deserve to die on account of not taking proper care of the children." Quite frequently she repeated, "I deserve it, I deserve it," or, "They are going to kill me because I say I don't want my children"—"They think I am not a good mother." In the beginning she heard her children at night say, "Mother, mother, you were not good to me." Again: "They say they did not want me any more, that I did not give them enough to eat." Or: "I did not care for my children, I did not clothe them, I did not feed them enough."

Repeatedly she said, "I am going to die," or "I am going to be killed," and it was quite striking that in contradistinction to the usual distress this was said as a rule rather placidly.

With all this there was associated not infrequently a peculiar "sensory-unreality complex": "There is something stiff in my mouth. My whole body is stiff. When I get my hand, I don't feel it." Or: "I don't care for my children. Did you ever hear anything like that?" (all this with marked distress). "I forget the faces of my children"—"Sometimes I can't remember my children. I forget all about my home." Again, "I can remember a little about my children." In connection with some of these utterances she once said, "I don't know what happened to me."

The test for orientation and for her capacity for intellectual operations during this entire period gave rather striking results. For an interpretation of these it is necessary to keep in mind two factors, namely, the patient's distress, and her illiteracy, and her probably low mental level. For example, she was never able to read the watch correctly, and she was not able to say exactly how much money would be left if she went to the store with a dollar and bought something for a certain amount. She invariably said she never had known that. Dates were difficult to obtain from her. Yet at the same interview she could tell how old her children were when the family came to the United States. The most striking fact was perhaps that she sometimes gave very absurd answers about her whereabouts; for example, she asked at one interview whether this was not Minnesota, yet during that same interview she knew exactly how long she had been in the hospital. On another occasion she called the place Castle Garden, again London, again America. She never could give the sequence of the months, but at an interview at which she gave very defective answers in this respect she knew it was summer and knew about how long she had been in the hospital. At another interview she said it was a hundred years since she came, but at the same time gave the ages of her children correctly. She always claimed not to know where she came from (the observation pavilion).

It is obvious that the significance of these peculiar answers is difficult to interpret, although the two factors first mentioned undoubtedly have an important bearing.

By the end of June the picture suddenly changed. She developed a peculiar motor excitement, with many purposeless, shaking, rubbing motions. During this she began to say, "I don't know what is the matter, I can't understand anything"—"I don't know the whole trouble," all this being repeated over and over, and there was only on one occasion an approach to the former content when she said, "I want forgiveness for my children." This reached its climax during a still greater restlessness in which she threw herself about in bed and against other beds and blindly shouted "police! police!" During this condition her physical health became poor and about ten days from the onset she was found with coated tongue, high pulse and tremulous motions, but she was markedly unresponsive and kept up a constant unmodulated moaning. The only thing she said at times during this interview was, "I know there is some trouble." Henceforth she was changed.

During the period that followed, that is, from July, 1916, to June, 1917, when the observation ceased, the patient did not change materially. She was now in a decidedly perplexed state; for the most part, sat around or walked about slowly with a perplexed frown on her face, and only at times during brief periods did she become more stirred up. The most prominent feature in the picture was that of her frequent statements denoting perplexity: "I don't understand"—"I don't know what is the matter"—"I don't know what has happened to me"—"How can I understand it? I thought they were doing

something bad to me"—"Everybody says something and I can't understand"—"I know there is something the matter with me"—"I know there is trouble"—"I don't know—they are talking something"—"What shall I do when I can't understand?"—"I don't know what people say to me"—"I don't know what is going on"—"In the morning they pull me, everything is pulling me. I don't know what it means."

The only approach to the sensory-unreality complex of the former period was seen in the following: "I can see but I don't understand what it means"—"I think my eyes spoil everything." Again she said, "My eyes are spoiled, I can't see."

To a much smaller extent depressive ideas came out at times: "I know I am no good"—"I don't belong to this place"—"It is too good a place, it is a place for people who know where they are." Or once when the doctor said to her, "Don't worry, you poor woman," she said, "I am not a poor woman, I am bad." Whereas in the former condition she said a great deal about her children, this was very rare and occurred only on a few occasions when she said such things as "They took the children away"—"They said I don't take care of my children." It was interesting that at such times she cried, which was not the case on other occasions. One night she got quite excited and claimed boats were on fire.

It is rather obvious from what has been said that nothing further could be discovered in regard to her thoughts. Whenever one wanted to find out what really bothered her or what her ideas were, one was met with her usual statement that she did not understand, that she did not know what was going on, and the like.

Similar statements were made when one tried to get at her capacity for intellectual operations and her orientation. Nevertheless, on persistent questioning in this direction, it became more and more clear that she knew the name of the hospital, the names of those about her, knew the time of the year, in spite of the fact that at first she often said she did not know. On another occasion she was able to give the names and ages of her children.

After this time the patient was transferred to the general wards of the Manhattan State Hospital. A report of July, 1918, states: From the observations made by the ward physicians it is evident that there has been no marked change for some time. In regard to her condition now, the nurse says the patient sits about the ward in a rather disinterested manner. She never speaks unless addressed and she never does any work. Whenever she gets a chance she wanders away. The reason she gives for running away is, "I am looking for my six children." In the ward she has to be urged to eat; however, she appears to be quite well nourished. She keeps herself fairly tidy and the nurse reports that she has recently improved in this respect. She does not wet or soil, and she does not have to be dressed or undressed.

On examination by Dr. Kirby the following was found: When interviewed, she is observed to be in a rather constrained attitude, her right hand being flexed and held rather awkwardly across the chest, the left hand resting on the chair by her side. She has a somewhat dazed, bewildered facial expression. When asked about her health, she replied quite promptly, "I don't know, I am not sick," and she then went on as follows: "I don't understand anything, I don't know what to tell you, I'm not sick." When told to put her hand down and assume a more comfortable position, she resented being touched and pulled away in a half-annoyed way, saying, "Don't touch my hand." Asked to give the name of the nurse, she says "Miss

Goldberg," and smiles. The nurse's name is McGoldrick and a good many of the patients really call her Goldberg. When asked if she knew the examining physician, she replied, "I don't know if that man is a doctor." At this point, when asked if she could smile, her face brightened up, she smiled a little and said, "I'm not sick." When asked about wanting to go home, she said, "I must go home with my husband, not with a strange man," and her eyes filled with tears.

She gives the day of the week correctly, knows the number of the ward in which she sleeps. Asked to give the name of the place, she persistently says, "I don't know," and later says, "I must go away now," moves to the edge of her chair and seems a little afraid. This becomes more marked when the nurse leaves. When asked where she formerly lived, and how she was taken away from home, and so on, she simply replies, "I don't know," without apparently making much effort, although she does not seem apathetic—on the contrary there is evidence of certain emotional tension throughout the interview and she makes frequent references to home. (What are the names of your children?) "I don't know." When the physician says in a surprised way, "What!" she replies, "The bigger one is Rachel and the other one is Judith." Asked, "Why did you say you did not know?" she replied, "I didn't know what to tell in English."

To all the rest of the questions asked she is apt to say, "I don't know." (Is your head clear?) "I don't know." (Are you troubled about anything?) "I don't know." (Are you happy or sad?) "I don't know. I am not happy—why should I be happy?" (Why do you at times try to run away?) "To look for my children—my girl told me (in a letter) to go home and I don't know where to go."

She is inclined to turn away from the physician and seems anxious to leave, and finally gets up and walks away. When passed in the hall by the physician she said, "I'm not sick; I must go home to my own children."

CASE 4.—Ida S., aged 25, married, was admitted to the Psychiatric Institute June 20, 1913.

Family History.—The sister-in-law says that both parents are living and are well.

Personal History.—The patient attended school very little, but can read and write. Practically nothing is known of her make-up, except that she was a good housekeeper, naturally cheerful, not worrisome, always helpful to others. She married her uncle (mother's brother) seven years before admission:

Her first child was born six years before admission. The birth was uneventful and no mental upset followed it. It is said that she never complained about her husband and never had any ideas of jealousy about him.

About a month before admission she was confined and the labor was easy. For three days after childbirth she was normal. On the fourth day she had a fever which lasted only a day.

About three weeks before admission she got depressed, said she would never get well, was very sick, had lost all her blood (she was flowing). Sometimes she did not answer questions; again was irrelevant. Finally, she said everybody was talking about her sickness; that detectives were watching her! It is also said that she tried to inhale illuminating gas.

Under Observation.—On admission the patient was well nourished, but she had a subfebrile temperature for a few days, dry lips and a coated tongue. She sat up in bed, somewhat distressed, whining or crying, sometimes when she heard sounds she looked about somewhat frightened; at times she was aim-

lessly resistive, or again she appeared rather sullen and had a somewhat dazed expression. She either did not reply to questions or answered by saying, "I don't know," or she wanted to be left alone; but when urged she would talk quickly enough. She then complained of not being able to breathe well, gasped, said her lips were dry, that her skin itched, that she wanted to go home. Her orientation was not established on account of her attitude.

For about three months following a day or two after her admission, the condition was as follows: There was considerable restlessness, associated with a mood of perplexed distress and often considerable talkativeness. Her productions were often poorly arranged and many sentences were left unfinished. Her perplexity in addition to being evident in her facial expression and manner, also manifested itself directly in such frequent statements as these: "I am all mixed up"—"I don't know where I am"—"I don't know how long I have been here"—"Everything is changed"—"There is no day or night"—"A thousand names have been given to me," etc.

For the rather disconnected talk, uttered with the foregoing described affect of perplexed distress, the following is characteristic (it should, however, be added that she is not fully conversant with the English language):

"Now they say the whole place is dirty—but now its people put here—poor people—and now they say whoever goes out and down below—there is an awful lot to be said—I couldn't remember exactly, and they say a whole lot and they all have to go to court—and of course they are all chasing me, out here—and a lot to be said—I am not sure of his name, he don't belong to me, my companion," etc.

The essentials of the trend which she thus produced were as follows: "There are lots of people here, good friends and bad friends"—"Half of the dead people they took out here"—"I see a whole crowd that got burned"—"The whole world is here"—"Half of New York is here"—"All the people are changed"—"Some house burned"—"They are all burned down"—"Too many people against one person."

Most of her ideas evidently came to her in the form of hallucinations of hearing and were chiefly of an accusatory character. She was blamed for various wicked things, and in her perplexed and distressed manner she kept protesting and denying them. The sexual accusations of which she spoke occurred more particularly in the first few weeks.

She said people were talking about her. Often the whistling of the boats and the footsteps of others seemed to be connected with such voices. Thus when a boat whistle was heard, she said: "See," or "That hurts me—from mouth to mouth." "She is called a thief, a crook; some buildings are burned, and she is blamed for it." "One time my name Ida, Ida, Ida—now that was—what can I do?"—"They all say it is my fault"—"The whole crowd is putting the blame on me"—"Everybody is suing me"—"People call me a whore"—"They say Ida is a whore for business"—"They say I had relations with men." Some of her perplexed protests were as follows: "I am respectable"—"They can't blame it on me" (in connection with her saying that a whole crowd got burned). Again: "Why should I go and be bad?"—"Everybody says something different"—"How can one person be for everybody?"—"I have to be bad and it is not my nature"—"My heart and soul say I am married—so many people for one person"—"But they ain't my husband."

Then she also said much about peculiar bodily sensations and bodily changes: "I am getting deaf and dumb"—"I am getting sores; I never had any sores on my body"—"The whole body itches"—"I cannot breathe, my

lips are dry"—"My blood is poisoned"—"I never sneeze, I never cough"—"My body is killed"—"My womb is twisted, some say it is due to childbirth, others say it is due to immoral life."

In spite of her frequent statements that she did not know where she was, that there was no day and no night, etc., it was found that when one could break through this mental attitude sufficiently, she knew more than would be indicated by her spontaneous utterances. Thus she knew this was a hospital on an island, knew she came on a boat, had at first been in a ward down stairs (correct). She gave approximately the date and the year, understood that one of the examiners was a physician, but was apt to be uncertain of the other, whom she called Harry Leon (a neighbor whom she knew only by sight).

From this more agitated state she gradually calmed down and for several months lay in bed, quiet, or stood or sat about with a rather doleful expression, at times whining, considerably reduced physically (six months after admission 36 pounds under weight), sometimes having a fetid diarrhea, and a rather swollen, red tongue. She now began to soil herself, was inactive, said little, often only shook or nodded her head when questioned, but she spoke quickly enough at times when sufficiently urged; often, with a rather disgusted air, she said she wanted to be left alone, or answered she did not know or did not care. The prominent content now was that she felt sick, dirty, that she was disgusting, covered with feces, rotten inside, that she will die, has poisoned herself, has no body, no eyes, no teeth, no husband, no children, is no good to anybody, is crazy.

Following this she became more active; at the same time her weight increased and she gradually returned to her natural state. Nevertheless, even nine months after admission, she was still languid, though without peculiar ideas.

An examination a short time before her discharge showed that she appreciated fully that she had been mentally unbalanced, but on account of her lack of education and rather low intellectual level a good retrospective account of the psychosis was not obtainable. It was, however, possible to demonstrate that many details of what happened in the hospital during her perplexed period were remembered.

CASE 5.—Elizabeth S., aged 28, married, was admitted to the Psychiatric Institute Nov. 24, 1914.

Family History.—Sister denies all heredity, but it was later found that a brother of the patient is wayward.

Personal History.—Both the husband and the sister claim that the patient was lively, made friends easily, was fond of amusements, and was in no way bashful or timid. On the other hand, it is also known that in childhood she often used to wet her bed, and later she not infrequently had fainting spells during her menstrual period.

Up to her marriage she worked as salesgirl, nursegirl, and lady's maid.

She was married three years before admission. After her marriage she again began to wet her bed at times and had five or six fainting spells since that time. Several of these occurred on the street, so that she had to be taken home in an ambulance.

The following incident should be mentioned at this point, because it plays a part in the later content of the psychosis: After marriage the patient at times worked for a woman, Mrs. D., doing sewing, and the like. This woman evidently was of a somewhat questionable character. About three years before

admission she made the patient a present of some silver spoons and forks. When the patient looked at these at home she found from the stamp on them that they evidently had not belonged to Mrs. D., but were the property of the hotel in which the latter lived. This upset her considerably, and she told her husband about it. She did not dare to return the articles to the hotel for fear that she might then implicate herself in the theft, and therefore hid them. The woman was also immoral, as the husband states, and about six months before admission he forbade the patient to associate with her.

Attack.—Eleven days before admission the patient told the husband that another woman (Mrs. M.) for whom she sewed at times, had had some towels stolen from her and that one of the servants told her that she (the patient) was suspected. (Later inquiries by the husband confirmed the correctness of the fact that the patient was told this.) After a day or two the patient became considerably upset about this and talked about being accused of stealing. The husband then took her to the theater in order to divert her, but there she became quite uneasy, said people were talking about her, were calling her a thug. Next day she fainted on the street and was taken to a general hospital, with the statement that she had "carbolic acid" poisoning. There it is stated that she claimed not to have taken "carbolic acid." She was depressed and imagined everybody was against her. She was discharged the subsequent day and sent to the observation pavilion. The notes from the latter place describe her as worrisome and restless, and as saying that the whole world was against her, that everybody was making fun of her and wanted to get her out of the way.

Under Observation.—For six weeks the patient presented a condition which was characterized by a more or less pronounced restlessness which manifested itself at times merely in a certain tenseness, but sometimes by twisting her fingers, pulling at her hair, walking up and down, biting her finger, and the like, and not infrequently by a certain uneasy talkativeness. What she said at such times was often poorly arranged, with unfinished sentences and much repetition, so that it was often quite impossible to understand what she was talking about. A few samples may illustrate this: "Are you a Catholic? You know I did not do anything wrong to anybody. You know I went to the place, I went to the theater and they said that I—I went to the theater—I never did anything wrong in my life—they said—you took me for a person that I was not, I never did anything in my life—I am innocent, innocent, innocent. I never hurt anybody's head in my life—what are they trying to do to me?" etc. Or, "I didn't accuse myself of anything—I am not—I only knew but one person—a woman told me one time that—the only one I knew about is Mr. B.—there was a woman one time said he was responsible for some girl's death, I don't know anything else—they said—the girl—the girl—that girl—they said she—she—I don't know—there was something queer—they said—that is the only thing I know about, I know nothing about anybody else—" etc.

There were many utterances which denoted a certain sense of confusion or perplexity, and she often looked half puzzled, half anxious or distressed. She spoke of being "in a muddle," "mixed up"—"I don't seem myself, I am not at all collected"—"I don't remember anything"—"Everything is dim"—"I don't know what it is all about"—"I feel as if something were woven around me." Or, "There is something in my life that is interwoven."

A very prominent feature in her condition also was an expression of guilt which seems to have come chiefly in the form of accusatory hallucinations

and toward which her attitude was invariably one of protest and denial: "I thought a woman was accusing me of something I didn't do; she lies"—"I didn't do no wrong; I am innocent of what they are trying to accuse me of"—"He says guilty, guilty—I am not guilty." We shall presently see that there are essentially three types of misdeeds she is defending herself against, namely theft, hurting people, and sexual matters, but she also was at times much more general about her profession of innocence. Thus she said, "They blame me for something I never did; I never, never did anything wrong." Or again, evidently referring to the accusatory voices, she said, "I don't know what they are talking about," and at one time she expressed a vagueness directly by saying, "There is something I am innocent of but I don't know what it is about." For the rest she said such things as "I don't owe any bills to anybody, I thought they said I did." Or, "Whatever I saved I saved honestly; I think they think I stole things, but I didn't; the only thing I am guilty of is petty thieving." (When questioned about the latter she explained, much more clearly than when she talked about the more indefinite matters, that when she was a salesgirl she sometimes took little remnants of silk.) Again she said, evidently referring to the matter mentioned in the history, "She gave me things but she need not say I tried to steal things; I didn't really steal things." Another set of ideas is as follows: "I never hurt anybody in my—the idea, I never harmed anyone in my life." The protests about sexual matters were as follows: "I never knew any man but my husband; I would slap any man who got fresh with me"—"I think they think—I am not bold"—"They said I had a child before I was married, but I didn't"—"I have no children; they say I have but I haven't"—"I never had anything to do with a negro; I said yesterday I got something from a negro and gave it to my husband. My God, this is not true, I never had anything from a negro"—"People think I want to break up my home." She also mentioned Chester G. several times, a man who evidently was a questionable character and whom she had known earlier in life, as she told us when she was less stirred up. It was at that time that she told us that she heard his name called in the theater. The following evidently refers to this: "They think I know something about Chester G. I never saw him since I am married," or again, "Isn't G. whom they want? He has two names." (He actually went under two names as was found out later.)

A certain feeling of danger was also expressed at times. She asked whether she was going to be sent to the electric chair, or said, "You are going to hang me"—"The woman in there said I was going to the electric chair. Please don't write that; I have done nothing wrong"—"People want to get me out of the way"—"I am afraid you are trying to hurt me"—"What are they going to do with me here?"

It is obvious that with the pronounced tenseness which we have described it was difficult to get the patient to concentrate. Therefore, orientation questions were sometimes not answered at all. She simply went on talking in the manner described, or quite often answered that she did not know. At other times she seemed to give a little more attention and then quite often gave answers which looked as if she were disoriented. She said she did not know how she got here and later that "it was all like a trance." But in the same interview, for instance, in which she said she did not know where she was and claimed not to know what the physician was, she begged him to "do something for her head," and later also spoke of the place as a hospital, though she added that it was a queer hospital. Moreover, when her husband came, during this period in which she appeared superficially to be so confused, she

gave him a detailed account of where to find certain things in the home. Or on one occasion, when asked who the nurse and the stenographer were, she claimed not to know, but later in appealing to them called both by name. At one time when asked for her husband's address she said, "He lives with me here," and then denied knowing her own address, yet later during the same visit she gave it correctly. At the third interview with one particular physician she was asked whether she knew that the doctor had talked to her before; she said, "Yes, but it is all dim."

In addition to the traits thus far described, there are a few which in view of the further course of the psychosis should perhaps arrest our attention. Thus she said now and then, "They have taken my mind off," or, "I have been hypnotized all the time I have been here." Although similar statements might occur in certain benign psychoses, there is a certain malignant ring to them. Perhaps of some importance is also the following: On one occasion, when she spoke of being accused of having had children, and she was asked how many she was accused of having, she burst out laughing, quite in contrast to her usual mood, and said, "A small orphan asylum I guess; I guess they thought I had them like chickens." But this was the sum total of any traits that might in any way arouse one's suspicion as to a more ominous outlook at this stage of her psychosis.

At the end of the period just described, the patient, who was quieting down somewhat, said to one of the nurses, pointing to her visiting husband, "This is R. S.; you can have him," but when confronted with the statement she became again somewhat uneasy and said, "No, you can't have him, he didn't do anything, he never hurt any one, it is Chester G. you mean." Again: "There are two R. S.'s, mine never hurt any one." This statement that there were two men by her husband's name was made several times during this short transition period.

Then followed a month in which her condition varied somewhat; now she was quite clear and placid, said herself that her mind was clear, but that it had been "confused and mixed up," yet even then, when asked personal questions, she was apt to say, "I have told you all I know about myself; I am imaginative and make little out of big things" (*sic*). At other times she answered even less well; simply said, "I don't know," or replied to all questions, "I want to go home." Again, she was entirely silent and for a few days there was a marked but uneven reduction of activity, during which she sat in bed with a half-puzzled, half-absorbed expression, sometimes mumbling to herself, and resistive to any interference, even striking those about her. Now and then a direct statement of perplexity still occurred: "Sometimes I am myself, sometimes I am not." (What do you mean by that?) "I don't understand anything, I can't explain it, I want to go home." During this entire period she was at times found masturbating shamelessly.

Then followed a period of about three months, not well demarcated, during which she was fairly natural and repeatedly said that her mind was all right now, and during which for the most part all perplexity had disappeared, and only now and then short spells occurred when she said she did not know where she was. Yet even then some ideas were produced, associated with hallucinations, which showed that the vague feeling was still present, that somehow some one wished to implicate her in some way: "Do you know anything about my case outside; could they hold me for things I don't know anything about?"—"They are trying somehow to connect me; why do they say pictures? I never gave my picture to any man; they say it was found somewhere." Or, "Lots of people's names are mentioned whom I worked for;

they are trying to connect me with things I know nothing about." Or, "Mr. B. once gave Mrs. D. an awful beating. Mrs. D. saved the bloody clothes and showed them to me. Now I think these clothes have been found, but I wasn't a witness." Similar ideas were also spoken of in a more retrospective manner: "Mrs. D. and Mr. B. used to go out together and register as S. (the patient's name). I think they were trying to hurt me for years."—"I thought Mr. B. wanted to get me out of the way so there would be no divorce; then he would not be correspondent in the divorce case. I thought there was a divorce case going on in the South. There they do not take a negro's word, do they?" (Why divorce?) "Somebody said Mrs. D. was going to have a divorce and I did not want to be brought into it." (Why negro?) "Only a negro and I knew anything that would get him a divorce." And finally she said: "When I came here a woman said, 'You look as if you had a child,' or, 'Outside they said my little brother (14 years of age) was my child,' and 'When I came here a woman whispered into my ear, 'He is your little boy.'"

It was during this period also that she gave, at various occasions, fragments of a retrospective account regarding the onset of her psychosis and the pronounced stage of it; that is, the first six weeks after her arrival here. The main facts of this are as follows: She claimed that when she was told that she was suspected of having taken the towels she went to Mrs. M. and told her she had not taken them. Mrs. M. said she had not been suspected; "Then I got depressed without knowing why."

Then she spoke of her experience at the theater. While there, she claims, she thought there was a "concocted scheme"—"I think now it was a scheme to break up my home"—"I only heard a certain voice; it was Mrs. D.; she had a terrible nerve to get up and condemn me. I got an awful blow; it was the last place I expected it, at the theater." This woman, she claimed, also mentioned the name of Chester G. and said he was wanted for a crime. On another occasion she said that at the theater some one was wanted for murder, "I wanted to yell—afterward they spoke my name, 'Elizabeth S. \$50,' or "Later she mentioned my name, then a crash came," or "My whole system went crash"—"and I got a heavy feeling, I felt I was going to faint." Again she spoke of having gone to a moving picture show (not clear whether this is the same as the theater but it probably is). Then "Something came over my whole system; my lips, my arms, eyes, everything; my whole body; I walked out as if I were in a trance, all in a quiver; I thought they wanted to use some influence over me; they wanted to break up my home," or "Some hypnotism was put over me; Mrs. D. and Mr. B. did it."

Then she also said that while still at home she heard her name called; that it sounded like some one in distress, "like my uncle," and that he said, "remember." At the general hospital they said she was wanted for murder. She evidently remembered clearly what happened both at the general hospital and at the observation pavilion, yet stated that the first part of her stay here seemed hazy.

For the following nine months during which she was still under our observation, the patient was again somewhat different, though again the transition was by no means a sharp one. In the first place, she was out of contact with her environment more than before and often sat in self-absorption somewhat slovenly in her appearance unless the nurses attended to her, and for a time at least wet the bed quite frequently. Sometimes throughout the period she suddenly attacked the nurses. Some of these attacks were plainly associated with hallucinations—thus she said that they made remarks about her, or "They

need not bring the whole family into it." At other times she had crying spells; again laughed boisterously.

The ideas giving expression to her feeling that there was an attempt to implicate her somehow were now almost absent, though now and then a statement such as, "It seems they want to get rid of me," or "Nonsensical people are writing about the electric chair," showed that there was still occasionally a feeling that there was something going on against her, which was similar to what we have seen before; or she spoke of having been "niggered" here; or complained of the harsh treatment that she had been subjected to. Such statements were usually associated with crying. On the other hand, as has been stated, she also quite often laughed boisterously. When asked what she laughed about she was sometimes unable to tell, but once she said, "I think of funny things." (Tell us about them.) "Well, for example, I see a paper and it says, *Hoch der Kaiser*—but I don't like Germans; suppose some one does a mean trick and you say *Hoch der Kaiser* to get back at them." Or she spoke of other hallucinations which were also more incomprehensible than her former ones, "Some one said pails of jelly, seventeen cents—my father paid for them," or, "Some one said foundling; I didn't come from foundlings." Once she said: "Mrs. D. is the whole shooting match here; they want to get something on me here; they will never get any immorality on me." But as a rule her former denials were no longer in evidence, Sexual hallucinations were evidently also quite prominent: "They talk a lot of smut; they ought to wash their mouths out"—"I know why I am kept here, for the filth of social aristocracy." (What do you mean?) "Does not socialism mean free love?" She also claimed that her husband was talking "smut" at her. Her attitude toward her husband settled down to an admitted indifference and dislike. "We never were made for each other; there was a lack of understanding between us; I never dreamt it was so terrible."

Of some interest is the fact that at one time she evidently mixed up the incidents connected with Mrs. D. and those connected with Mrs. M. by saying, in speaking of Mrs. D., "She gave me some towels and said she paid for them" (Mrs. D. had given her silver and she was accused of stealing towels from Mrs. M.).

It should be added that fainting spells occurred at no time while she was under our observation.

In May, 1916, the patient was transferred to the general wards of the Manhattan State Hospital, where she remained for another year. The report from there states that while at times she was occupied somewhat, she was for the most part without much initiative and appeared self-absorbed. Till the end she was by no means free and natural. Sometimes for the first six months she had spells of screaming and irritability in which she suddenly attacked those about her. These gradually disappeared. Occasionally she made statements which still resembled her old ideas—"Something is going on but I don't know what it is," or, "They confine all people to one person." And when she was finally discharged June 4, 1917, it was demonstrated that she had no insight whatever into the morbid nature of the state she had gone through or of the ideas she had held, nor had she any desire to join her husband. She was taken to the house of her sister in another state.

CASE 6.—Elizabeth H., aged 20, single, was admitted to Psychiatric Institute March 7, 1904.

Family History.—The father is living and well. A paternal aunt was insane. The mother died in her ninth confinement. The patient has eight brothers and

sisters: one dead, the rest living, patient being the eighth. They are said to be well, with the exception of a sister who had nervous spells with "crying and fainting," which ceased with marriage.

Personal History.—The patient was $2\frac{1}{2}$ years old when her mother died. At first she was taken care of by an aunt, then sent to an orphan asylum, and from her fourth year she was brought up by her stepmother, who treated her badly, so that she always desired to get away from home. Yet she was of a jolly disposition, liked company, "was always with the crowd," and worked rapidly.

When 5 years old she fell on her head, was unconscious for some hours, but recovered without sequelae. When 16 she was married and is said to have been happy.

When 17 (May, 1901) she had her first child. Two days after childbirth the sister who was taking care of her accidentally broke a bottle of medicine. The patient got inordinately irritated at this. Then she also got irritated at the sister because the latter used to leave her alone to talk with a neighbor (a rather giddy woman, as the patient said). Five days after childbirth she began to feel blue and her milk stopped flowing. On the tenth day she tried to get up but felt too weak. She was feverish, sleepy. At the same time she was annoyed when the baby cried. The baby was taken away. About the sixteenth day, according to the patient's own statement, she got up but felt lightheaded, had no energy, had a "silly" feeling; "I got to laughing and could not stop." She complained of noises in the head but not of voices. Her people say she seemed to take no interest in anything, laughed in a silly manner, had a far away look, and a voracious appetite. Five weeks after childbirth an operation for laceration of the cervix was performed at a hospital. When she returned from the hospital she was quite natural. After this the only difference was that she would no longer associate with the woman to whom the sister had talked, because she felt this woman had made her sister neglect her.

When 19 (July, 1903) she had a miscarriage. For a week she felt weak. About this time the sister-in-law's baby died and she was anxious for a time about her own child.

Present Attack.—She had an influenza about three months before admission (in bed a day, feverish, coughing, sneezing). For two weeks she felt rather downhearted and unable to do her work.

Two months before admission, while at her stepmother's house, she and the latter had a quarrel. The stepmother scolded her, accused her of having stolen some things from the house, and threatened to have her arrested. It is said that the patient turned white on this occasion, seemed much affected and slept badly that night. She became abnormal at once, seemed dazed, let the food burn on the stove, wept much, complained of a full feeling in the head, felt dull, drowsy, could not work. Retrospectively the patient said she felt her memory was going, that she could not think well: "I had to force myself to speak." She also claimed that for three days she did not speak at all. At night she imagined that the stepmother was haunting her. Then she began to say that some things in her house were not her own. She explained later that this was because she thought her husband had given these things away and that this was connected in her mind with the fact that at one time her sister had jokingly said that the patient on her death should leave her watch and chain to her. She began to say that she was bad, and expressed

the idea that she should not have been married, and again that they were pouring kerosene over the child.

Two weeks before admission she was taken to her sister's home. There she is said to have been quiet, motionless in bed, with a dull expression, pale. Yet she spoke at times, then chiefly about having stolen, and she seemed afraid of being arrested; when she heard wagons outside she thought the patrol wagon was coming for her. She had attacks of throbbing in the head, palpitation, numbness and stiffness in the body and limbs. These would last for an hour or so. She claimed these attacks were due to electricity, ether, or opium, and that she was being poisoned. Again, she spoke of having lice, and said bugs were in the bed. She heard voices, singing "Nearer my God to Thee," saw angels on the wall, smelled bad odors. Toward the end she refused food.

At the observation pavilion she is described as being rigid and resistive, again passive. She thought she was in a church; was getting the communion.

Under Observation.—On admission the patient looked pale (hemoglobin, 70 per cent.), had a coated tongue, dry lips, a temperature of 99.8 (this did not persist). She appeared dull, was resistive, gazed about fixedly and in a perplexed manner, half dazed, half uneasy.

For about two weeks she was kept in bed. During this time she was often quiet, gazing about in a dull, yet at the same time perplexed, manner; for the most part there was a reduction of activity and her movements were rather slow. She was apt to resist when anything was done for her, frequently refused food and had to be spoonfed. She also held her urine and had to be catheterized. Sometimes she masturbated. The most prominent feature was the fact that when anything happened her attention seemed to be easily attracted by it, and she was apt to comment on it in a perplexed whining manner. Thus, when dishes were brought, "These ain't my dishes," or, when something was said, "I didn't say that," or "I hear boats and whistles; I never lived on the water," or, when she took hold of her hair, "Who put all that hair on me," or, when the doctor came, "I don't know you," or "That ain't mine."

She also often gave direct expression to her feeling of perplexity by saying, "I am all twisted"—"They got me twisted." Or she said she was "dizzy."

Sometimes she made depressive statements, "I am no good"—"Throw me in the river"—"I stole from everybody, I ought to have been locked up in the court house," and often she said, "I have been in a bad house"—"I ought to have been taken to the station house"—"Everybody says I steal things."

Her attention was hard to get so as to make her answer questions, because she was too easily distracted by external happenings on which she commented in the puzzled, whining manner described. Therefore questions were often not answered. For the same reason her orientation was difficult to establish. Yet on the second day it was found that she knew where she had come from, how long she had been in the hospital, also that it was a hospital, though she was puzzled about this as well, as was shown by her statement, "I don't know where I am; it looks like a hospital." The month she gave as June (March) but knew the year correctly. On another occasion she called the place "the Holy Catholic Church," again "the Varnish Works." But this varied, and more often she was found to be quite well oriented. When asked where she lived, she gave the street and number of her father's home, claimed she did not know where her husband lived, and could not be made to give her married name. (Are you married?) "I thought I was married, but I was not married; I found out afterward it wasn't his name." (No foundation.) When on one

occasion she was made to write her married name, she did so but kept repeating "That ain't my name." When an attempt was made to make her calculate, she seemed unable to do anything but simple sums, and said, "I can't do it." But she gave some old events of her life quite well, with the time of their occurrence.

After two weeks she was allowed out of bed. She stood about or walked around slowly. The condition did not change much; the prevailing mood remained one of whining perplexity, but her utterances became more frequent, at any rate when one spoke to her, and were somewhat different, as will be seen. On the other hand, she sometimes smiled readily at funny incidents or at her own absurd remarks, or she smiled when the doctor smiled. It also became evident that hallucinations were more prominent. The following are representative utterances:

"They say I catterize people here, that I give them all kinds of medicine. They say I am so swell that I spoil all the clothing in here, I ought not to be here, I can't afford to pay the money—that I do everything, that I spoil the holy wash—they bring dishes up here and everything—I don't know who owns this house." Again: "They say the men in here are bad, the priests and all; I don't know whose chairs these are, I never said anybody was bad—They say I owe everybody so much money for clothes, I never took any money, I never led any girl astray, if they go it is none of my business"—"I never gave anybody any medicine, the nurses give a lot of medicine—I never talked French" (another patient had said something about speaking French)—"They say I live on \$100 a day, I haven't got no money"—"All the wrappers they brought up today"—"They made them take off their clothes" (at the bath)—"They say I created the earth, that I have a yacht—I don't." When something was said about graham bread, "Mr. Graham is not my brother." When a nurse swept the floor, "I did not make that dirt"—"They say I am a dog"—"They say I eat rats but I don't"—"They say this is a whorehouse, everybody dirty, rotten people and Coxey's Army." Again: "They say I stole everything—this is no whorehouse"—"They killed geese in here and I ate them"—"They say I own this house."

The condition gradually improved. Toward the end of it she wrote a letter to her brother saying she felt better; that she had been insane; that her husband had sent her to Bellevue Hospital, and that she felt in everybody's way. She signed this, "Your loving wife."

By the end of May she became freer and somewhat elated, a little overactive, a little talkative, somewhat forward, but without flight of ideas. She admitted herself that she was overtalkative. This lasted only two or three weeks. Then she got perfectly well, with good insight. She was discharged June 27, 1904.

Retrospectively: It was demonstrated that she recalled well all the incidents connected with her entrance to the hospital and many incidents later, but she claimed that at first she thought she was in New Jersey or that she was in a church, and she claimed she was not clear where she was for two weeks. As to how she felt during that time, she said she felt dizzy, her hands felt numb, her skin tough, her blood did not seem to circulate; all days seemed alike; it was as if the end of the world had come. Her thoughts wandered; the questions dumbfounded her; she felt mixed up.

A prominent idea throughout was that she had stolen and was to be arrested. She had a feeling that everything referred to her. When people turned around she sometimes thought it meant she had to change her religion. Nobody but

very rich people seemed to be about her, and she thought she had to bear all the expense. She was afraid to sit down, because she thought she would have to pay if she did. Voices were prominent. She was called bad names. They came out of the register; once she thought she saw her husband and child outside.

CASE 7.—Ida N., aged 34, married, was admitted to Psychiatric Institute Jan. 25, 1905.

Family History.—The patient's father was drowned. Otherwise nothing is known about the family history.

Personal History.—When about 15 the patient had some sort of "nervous fever," during which her hair came out. It is thought that since then some traits which are said to be characteristic of her, namely, that she was nervous and easily startled, had become more marked. When 19 she came to this country and worked as a servant girl.

Soon after coming to this country she began to go with her later husband, and after a year had a baby which died in six months. When she was 22 she began to live with him and then had a second child (living at time of second attack). The husband states that she was a good housewife, a conscientious mother, and a sociable neighbor.

First Attack.—At the age of 27, in 1898, she had a former attack and was treated at the Manhattan State Hospital. From the notes made at that time and from the account which the husband gave at the second admission, we gather the following: It came on in the early part of her third pregnancy (after recovery from her second attack the patient said it was caused by the worry about her irregular position). She began to complain of hoarseness, pain and choking in the chest. Two days before admission to the observation pavilion she seems to have become definitely abnormal. She got uneasy, said the neighbors were down on her, had been talking about her and wanted to harm her. She became quite upset, wrung her hands a good deal, insisted she had done nothing, wanted to see all sorts of neighbors. The following night she became quite excited, jumped around and sang, but it is claimed without appearing happy.

At the observation pavilion she is described as uneasy, biting her lips, saying something was going to happen and that the people were talking about it.

At the Manhattan State Hospital, where she was sent after a few days' residence at the observation pavilion, her psychosis lasted two weeks. She is described as agitated, walking up and down, distressed, swaying back and forth, pulling at other patients, affirming she had done nothing. When questioned, she often said, "I don't know." The notes also state that she spoke of her husband having left her (not true).

Then she got perfectly well, active, natural, helped on the ward.

After she was discharged her husband married her and she remained well. She had her third child without any upset and later a fourth.

Present Attack.—Two months before admission she heard of some gossip about her past which actually had been going around. The husband said she worried a good deal about this but was not decidedly abnormal.

Two weeks before admission she again got hoarse, complained of pain in her chest, and at about the same time a woman acquaintance, referring to the gossip, said to her, "You have awfully bad friends, but I will tell you about it when your cold is well."

Six days before admission she had a scene with the girl who was largely responsible for the gossip, but unfortunately no details are known about this conversation. Having appeared normal, or at any rate nothing more than worried, up to that time, she now became restless, began to sleep poorly, told her husband that the neighbors were down on her, were trying to harm her if they could. She kept walking up and down talking about this, yet she did not tell her husband what she was accused of but said she was blamed for giving a Catholic woman meat on Friday (the day before). (On recovery the patient stated that this woman had some meat, but that it was uncooked so that she did not know whether she ate it on that day, and that she had not given it to her.) She became restless as time went on, moaned, and finally got quite excited and shouted. At the observation pavilion she is said to have appeared depressed and dull. She kept affirming that she had not killed anybody and that something had been given her to make her sick. No mention is made of any perplexity.

Under Observation.—On the first day she looked dull, preoccupied; when questioned she was apt to repeat the question in a rather perplexed manner and often without answering, but she repeatedly spoke spontaneously; said "What about the girl?—I never see—I don't know if she did—I never have done anything to her—people here—people here." But she could not be made to tell more clearly what she meant. In spite of the difficulty in obtaining answers, it could be established that she was oriented.

Then for two weeks her condition, though similar to that of the first day, was different in so far as she appeared more perplexed and more puzzled by what she saw and heard. It may be described as follows:

She showed, above all, a marked perplexity and uneasiness. She was apt to turn to everything which happened, commenting on it in a puzzled manner, asking what things meant, such as the temperature taking, the medicine which was brought, the acts of other patients, and, for example, when the doctor's glasses fell off, she would say, "Why did they fall off?" and when he put them on, "Don't do that," or when he wrote, "Don't write," or she repeated in a perplexed manner something which she heard as if she could not grasp its significance, or when she heard a patient curse, she said, "Oh my! I never said anything like that." In fact, she often remarked in this way on every change in attitude of those about her. When asked questions or asked to do anything, there was great hesitation, though the individual motions were not made slowly, or individual sentences were spoken quickly. She was apt to repeat the question with a rising inflection but frequently without answering it. Or, for example, when asked to put out her tongue she would say, "Put it out," without trying it. (Give me your hand.) This had to be repeated often. Finally, when asked whether she could not do it, she said, "Yes, I can do that too, I can give my hand." (Don't you want to?) "Yes, I want to," but she made no attempt. (Shake hands.) "Yes, I will shake hands." Makes no attempt. Finally, on repeated urging, does it slowly, again interrupts it. As the doctor goes, she put out her hand. In eating she also made many hesitating, unfinished movements without accomplishing anything. Frequently she said, "I want to talk to you," but produced nothing, yet when the physician turned to go, she would say, "No, stay," or she would say, "Yes, I will tell you, sit down, don't write—don't do that (as he turns over the pencil)—I will tell you—I ain't done nothing—don't look at the time," as doctor glances at the clock, etc. The statement "I haven't done nothing" was extremely frequent and quite often she added "I haven't done anything to that girl." Or

she said, less frequently, "Let me live a little longer," "You will save me," or "You wont lock me up."

Usually the things which happened about her merely called forth the statements of perplexity or appeals to stop it or affirmations that she had nothing to do with it. She never elaborated her perplexity or uneasiness into any definite delusions of apprehension or reference, with the exception of the fact that she said a few times, "They are all laughing at me."

The orientation was often not easy to settle, on account of her difficulty in giving complete answers, but with persistence it could be established that she was pretty clear about the time and the fact that she was in a hospital. There was no definite evidence of hallucinations.

Feb. 8, 1905, she began to ask for work and occupied herself somewhat, yet the other traits continued to quite an extent but diminished during the following two weeks. Then she became quite active and natural, and was discharged recovered (March 27, 1905).

Retrospectively: It was shown that she had a good recollection of the happenings at the observation pavilion and here, thus showing that there had been no essential clouding. She stated that on the boat she was frightened by seeing a girl on a stretcher. She thought the girl was drowned. She claimed it was this she referred to constantly by saying she did not kill the girl. She also said she was always frightened of the water, and mentioned in this connection that her father was drowned. As to a possible cause of her breakdown, she spoke of the fact that she was made nervous by the gossip, but even when quite well was inclined to be reticent about the details of this and only reluctantly admitted that the gossip was about her past.¹

ANALYSIS OF CLINICAL PICTURES

These clinical pictures, though they differ among each other in certain details, have yet a good many features in common, which justify our classing them together. These we will now take up in detail.

A. Perplexity.—The first feature is the evidences of actual perplexity. The most frequent, observed in Cases 1, 2, 3, 4, 5, 6, are the direct statements that the patient is "confused," "mixed up," "muddled," "twisted," "does not understand." In such utterances it is not at once clear to what this mixed up feeling refers, that is, whether, to use Wernicke's phrase, this perplexity is autopsychic or allopsychic. The other utterances, however, show us clearly that it is chiefly a perplexity of the latter kind, with which we are here dealing. We shall have to refer to this again when we deal with the question of orientation and of the capacity for intellectual operations. For the present we will only state that we often find such statements as "I don't understand things"—"I cannot grasp things"—"I don't know what is going on"—"It is all a mystery"—"I don't

1. The fact that all the cases here reported are women need have no particular significance, since it may be due to the distribution of the clinical material at the Institute, which has purely external reasons.

know what is the matter"—"I don't know what it is all about"—"I can't tell anything about anything"—"I don't know the whole trouble." Patient 4, who had many hallucinations, said: "Everybody says something I can't understand." Patient 3 said: "I don't know what people say to me." "They are pulling me. I don't know what it means." Patient 7, though she did not give direct utterance to a feeling of perplexity, frequently asked in a puzzled manner what trivial occurrences meant, or repeated statements which she heard with a puzzled expression. Compared with these utterances, those which might denote an autopsychic perplexity are distinctly in the background. Patient 1, who, like the rest, expressed her allopsychic perplexity by saying she could not grasp things, said: "I don't feel straight" and "I don't know how I feel." Patient 5 spoke of not remembering anything, and Patient 2 spoke of her mind being weak, of not being able to remember, and asked "Am I silly or crazy?" again she said, "I don't know what to do." In this same category should also be mentioned the statement of Patient 5, who said, "There is something in my life that is interwoven." The perplexity was also shown in the facial expression in many patients. This is mentioned in the notes in five out of the seven cases, which of course need not mean that it was not also present in the two remaining ones.

We can summarize, therefore, by saying that all patients showed perplexity either in their facial expression or in certain utterances denoting a feeling of being mixed up, and that this latter referred especially to being mixed up in regard to the environment. A certain amount of autopsychic perplexity was shown, in addition to this, in some cases.

B. Orientation.—For the reason that the patients expressed so much confusion regarding the environment, it seems best to take up next the question of orientation. The striking feature here is that when orientation questions were asked the answers often made one think that the patient was seriously disoriented, as might be expected from what has just been said, yet on further examination it was often found that there was more a subjective sense of confusion than an actual persistent incapacity to elaborate the data of the environment. This conclusion was also repeatedly borne out by an examination of the patient after recovery, when it could be shown that she had a clear recollection of the events which happened during the psychosis and of their relation and significance.

The most frequent experience was that the patient said she did not know, when asked orientation questions (1, 3, 4, 5). At other times it was impossible to fix the patient's attention sufficiently so

that any answer could be got. This was especially true in Cases 6 and 7, patients who were constantly distracted by trivial happenings in the environment. There were also some more specific statements: When Patient 5 was asked where her husband lived, she said, "He lives here with me," or again, she said spontaneously, "I don't know how I got here; it is like a dream." Patient 4 also said, "I don't know where I am; I don't know how I got here." Patient 1 said that the days were mixed up, and Patient 4 that there were no days or nights. Yet on further questioning the results were different. In Case 1 it was found that in reality the patient was clear about her environment at the time as well as retrospectively after recovery. Patient 3, in spite of frequent statements that she did not understand, knew the names of the hospital and of the people about her and approximately the time of the year, while Patient 4 knew at least that she was in a hospital on an island to which she had come in a boat; also that she had been first in another ward. She knew, moreover, the date, approximately, and at one examination knew the physician was a doctor. It was also possible to show after recovery that she remembered many details, even of the early part of her stay at the hospital. A similar situation obtained in Patient 7, who knew she was in a hospital and was approximately clear as to time. Above all, we could show after recovery that she had a good recollection of the external events which happened during her psychosis. The discrepancy between subjective and fundamental confusion was well brought out in Case 5. This patient, during the same interview in which she claimed not to know where she was or who the doctor was, asked the latter a little later to do something for her head, and spoke of the place as a hospital; or when questioned about the names of two nurses, claimed not to know them, but later in the interview spontaneously called them by name. In the same way she claimed not to know her own address when asked for it, but later gave it correctly. In this connection it should also be mentioned that in the midst of this state, when she claimed to be so confused, she gave detailed directions to her husband as to where he could find certain articles in her home. In Case 6 we have evidently at times something more than merely a subjective confusion. The patient gave the date as June instead of March, and called the place the Holy Catholic Church, or again the Varnish Works, and retrospectively she claimed that she actually thought at the time she was in New Jersey or in a church. *But even this case showed correct orientation in the midst of this period at times.* Case 2 differs inasmuch as the patient's sense of confusion was not so much brought out when questions about orientation were asked, as

it was uttered spontaneously, so that in her case no difficulty was encountered in establishing her orientation.

These experiences may be summarized by saying that usually orientation questions brought out the statement that the patient did not know the answer, or called forth directly wrong answers, but on further examination the answers were, at any rate, much better than would have been expected from a more superficial analysis. In only one case did we find a more decided interference, inasmuch as the patient not only did not give the time even approximately and was disoriented as to place, but also said retrospectively that she had not been clear at the time. Yet even here the orientation during the same period was on other occasions correct. We can state, therefore, as we have already done, that the chief reason for the apparent disorientation is a purely subjective sense of confusion which we also found constantly expressed in the spontaneous utterances. That there may nevertheless be at times a certain if only temporary difficulty of elaboration is shown in Case 6.

C. Changes in the Sphere of Emotions, Thinking and Action.—

In order to make the further description as natural as possible, it seems to us wise not to tear asunder too much the changes in the realm of the emotions, thinking and action, in spite of the fact that we have, for obvious reasons, already taken up the orientation. We know from our experiences with the essentially affective reactions, especially those purest forms which we call manic-depressive psychoses, that we are apt to find closely related alterations in these three fields.

The affective changes were quite marked. Our cases invariably showed, in addition to the perplexity, a pronounced uneasiness or distress. In five out of the seven cases this uneasiness was associated with a decided restlessness, whereas in the two others more with phenomena of inhibition. Patient 1 showed restlessness in constantly moving her hands—pulling at her clothes, brushing herself, or making meaningless motions with her hands. On the other hand, she was very slow in answering questions which referred to her worry, but this was out of proportion to any general slowing of answering, though she calculated slowly but correctly. In Case 2 the notes merely state that the patient is mildly but constantly restless. In this case there was a marked difficulty in thinking when any concentration was required. Patient 3, whose psychosis lasted much longer than that of the others, had but little restlessness. She sat about or often walked about slowly, but she had periods when she became stirred up and was then more restless. She was very uneducated and probably slightly defective intellectually, and no special

effort was made in this period to study her capacity for thinking. Patient 4 was often very restless and at times quite talkative. Here the train of thought showed interesting changes. The sentences were poorly arranged and appeared disconnected, yet they were nevertheless held together, as it were, by the fact that the entire talk was dominated by an affect of distress which imparted to it a complaining tendency. Patient 5 showed a more or less pronounced restlessness which manifested itself at times merely in a certain tenseness, again in twisting her fingers, pulling at her hair, walking up and down, biting her fingers, etc., and not infrequently in a certain uneasy talkativeness. This patient, too, showed changes in her train of thought similar to Patient 4, as here again there was a poor arrangement of sentences, many of which remained unfinished, while there were also many repetitions. It was as if she kept interrupting herself, then took up the thread at a different place, while she also had a constant tendency to repeat herself. But here again the whole train of thought was held together by the feeling of distress and the fact that the talk was concerned essentially with one topic, namely, her protestation of her innocence. Of interest in this connection is the fact that, when the patient gave an account of some matters in her earlier life on one occasion, instead of talking of her immediate feelings as usually, the train of thought became much more connected. Of course it was under the circumstances impossible in both of these cases to make them concentrate on any tests. In this connection we should also mention the remarkable excitement by which the perplexity in Case 3 was ushered in. The patient suddenly began to show a pronounced motor restlessness with marked distress associated with many apparently purposeless shaking and rubbing motions, while at the same time she kept repeating: "I don't know what is the matter"—"I don't understand anything"—"I don't know the whole trouble." Finally this motor excitement rose to throwing herself about in bed and against other beds, while she kept shouting "police." This was followed by a state of exhaustion and then by the perplexity reaction already described.

As has been said, the last two cases differed. Patient 6 was often quiet and there was a distinct reduction of activity, with rather slow motions. With this there was associated a tendency to resistance when anything was done for her, frequent refusal of food, which necessitated spoonfeeding, and holding of urine so that she had to be catheterized. Her attention was difficult to get, and she could not be made to calculate anything but simple sums, saying, "I can't do it," yet now and then she gave some data of her life quite correctly, even with the time of their occurrence. Patient 7 showed, above all, a great hesitation when questions were asked, although

individual motions were not made slowly and individual sentences were spoken quickly. This hesitation showed itself in answers and in executing commands. She was apt to repeat the question or the command without being able to answer or to carry out what was asked of her. Frequently she interrupted her half-finished movements by counter-impulses, so that there seemed to be a constant interplay between agonistic and antagonistic impulses. In the same way she would frequently call the doctor back, when he was about to leave, with the statement that she wanted to say something, but without being able to bring herself to say anything. Under these circumstances few questions were really answered.

If we try to summarize and interpret what we have found in the realm of emotions, thinking and action, we must state in the first place that all cases show marked distress which in four of them was associated with marked restlessness; in one, a case of much longer duration, with episodes of restlessness only; whereas in the two others inhibitory phenomena dominated the situation. In the first group we find two cases in which there was a decided difficulty in thinking with moderate restlessness, and in one of these besides, a slowness in response. But the slowness of response in this case was limited to the answering of questions referring to her worry and probably finds its explanation in the fact that this worry was not formulated. We shall presently see that this is an important integral feature of the perplexity reaction. It may be well to remark here that we find cases of manic-depressive depression at times in which the patients show not only a moderate retardation, but occasionally an additional hesitancy when their feelings are inquired into. In contradistinction to what is commonly found, this makes the retardation very uneven. It is not impossible that in such instances we are dealing with an addition of perplexity features superimposed on the simple depression. The thinking disorder which showed in slow calculation or in a general difficulty in accomplishing intellectual tasks in which concentration was required, may be fundamentally similar to the well known thinking disorder of manic-depressive insanity.

Special reference should be made to the interesting disturbance of the train of thought which we find in the two cases in which, in addition to the distress and restlessness, there was present a marked talkativeness. We are well aware that in states with pronounced affective changes we are apt to have certain characteristic abnormalities in the train of thought. We only have to remember what we find in manic states and in certain conditions with marked anxiety and restlessness. If, therefore, we have here a peculiar train of thought, in some instances, which consists in a poor arrangement of sentences, a stopping in the middle, a picking up of the theme at

another place, and a tendency to repetition, we must admit that this is a disorder which is psychologically not unexpected on the basis of the entire perplexity reaction, and we must regard it, therefore, as an integral part of some phases of this reaction.

We have to dwell a little more at length on the inhibitory phenomena which occurred in Cases 6 and 7. In Case 6 the general reduction of activity and the slowness of motion was again not unlike the retardation of manic-depressive depression, and the distinct difficulty in thinking may be fundamentally also akin to this. But in addition to this there were also present certain negativistic traits (resistance, refusal of food, retention of urine). Unlike the typical catatonic negativism, these phenomena in our cases existed, however, in a setting of distress. Now we know that in anxious states we not infrequently find a marked resistance—the patient wards off all interference with a definite idea that there is danger and that something terrible might happen to him. In our cases, however, we can hardly assume that the distress led to anything like the clearly elaborated ideas which we find in these anxiety states. Certainly the holding of urine cannot be thus interpreted, especially not in the absence of any delusions about it, and the same may be said about the refusal of food. But it must not be thought, it seems to us, that such a symptom as catatonic negativism is necessarily fundamentally different from resistance with a good cause. The essential of all these reactions is probably an attitude of opposition as a protective mechanism. That in dementia praecox there exists a negativism which is utterly independent of any affect or logical idea is due to the fact that here automatic mechanisms come into play on account of the fundamental disorder of this disease, which unfortunately has not yet been clearly grasped by anybody, but which Kraepelin has called a disorder of the will. From that point of view we can well understand that in various psychopathic reactions there may be transitions from the more elementary and utterly incomprehensible negativism to one which is logically determined. This excursion was necessary in order to show how in our opinion the reactions in Case 6, which impress us partly as purely negativistic, partly as arising on an affective basis, should be regarded.

Interesting is the situation in Case 7 in which we find many peculiar inhibitory phenomena not unlike so-called catatonic symptoms, namely, the constant interruption of acts and the peculiar interplay between agonistic and antagonistic impulses. It is perhaps less remarkable that these phenomena are present in this case than it is surprising that they are not present in more of them, for they certainly do make the impression of a perplexity in action. We are here reminded

of a statement by Bonhoeffer² that in catatonia the alternation of negativistic and agonistic impulses produces a typical perplexity. With this interpretation in mind we naturally ask whether in our case this frequent change in the direction of the impulses does not, in part at any rate, produce the perplexity. Although we have not at hand any observations of real dementia praecox cases in which the phenomenon was present, and have for that reason perhaps no right to pass judgment on an explanation which refers specifically to those, we are inclined to think that Bonhoeffer's explanation is based on the general tendency of the Wernicke school to regard "catatonic" phenomena in the light almost of focal, or at any rate, fundamental, symptoms which give rise secondarily to other manifestations. This, however, is, after all, still a hypothesis, and to our mind it is rather unlikely that it has any wide application. Certainly, in our case, it would seem forced to accept such an explanation, considering the fact that in the material here presented perplexity is present so often without those "catatonic" phenomena. On the other hand, the assumption given in the foregoing that for some reason or other this frequent change in the direction of the impulse is a partial manifestation of the entire perplexity reaction, is more probable, although we frankly admit that we do not know why it should be present in only one of our cases.

D. Content of the Psychosis.—We next come to the content of the psychosis in these cases. In discussing this we will start with Case 4. This patient hallucinated freely. The hallucinations were almost invariably accusations of various misdeeds. She was called a thief, a crook; there had been a fire, a whole crowd got burned, dead people were taken out and she was blamed for it. Then again she was called a whore, accused of relations with men. Everybody was chasing her, suing her, the whole crowd was putting the blame on her. But these accusations were not accepted by the patient; they had no counterpart in anything like self-accusations; on the contrary, she constantly protested against them. In regard to the fire she said "They can't blame it on me." About the sexual accusations: "I am respectable"—"Why should I go and be bad"—"I have to be bad and it is not my nature"—"My heart and soul says I am married—so many people for one person." That the last has a sexual meaning is shown by the statement "But they ain't my husband." There are some other statements which are not clear in their significance, but it is evident that the main part of the content is contained in what is given above. We should add only that to the

2. Bonhoeffer: Die Psychosen im Gefolge von akuten Infectionen, Allgemeinerkrankungen und inneren Erkrankungen. In Aschaffenburg's Handbuch d. Psychiatrie, Special Part, Section 3, First half, p. 70.

patient these hallucinations evidently gave a sense of great multiplicity, as she said, "Everybody says something different." The essential in this seems to us to be the fact that there are numerous hallucinatory accusations against which she protests vigorously. The condition in Patient 5 was in many ways similar. She, too, had many hallucinations accusing her of misdeeds and against which she constantly protested: "Whatever I saved, I saved honestly—they think I stole things but I didn't," or "I never hurt anybody, never harmed any one in my life." Or in the sexual sphere: "I never knew any man but my husband," or "They said I had a child before marriage, but I didn't"—"I never had anything to do with a negro," etc. She also said, "I am innocent of what they are trying to accuse me of." Here a new element may enter. While in the utterances just cited the patient was clear of what she was accused but denied it, it is here possible that she may not even be clear about what the accusations are. That this is at times definitely the case in this patient is shown in the following utterance: "There is something I am innocent of but I don't know what it is." Into the same class of phenomena probably belongs her statement, made at times, that she did not know what the voices were talking about. Therefore, here again we find, essentially, hallucinatory accusations and vigorous protests against these accusations, together with evidence that here and there the accusations are not formulated.

A transition to the next group is Case 2, which presents a phenomenon similar to the preceding two cases when the patient said, "What do they mean by saying I stole?" Here we have at any rate a lack of acceptance of the accusations. She also showed a feature which is similar to that which we find in depression, that is, she felt she was wicked and asked, "Have I done wrong?" But here the striking fact is that she was unable to say in what her wickedness consisted. There were, therefore, accusatory hallucinations which were not accepted, or when there were no hallucinations she had a feeling of wickedness, but this was not formulated or focussed. This is a similar principle, therefore, to that which we have found indicated in Case 5. We find it again in a marked form in Cases 1 and 3. Patient 1, in the beginning of our observation, had a few well-formulated ideas of self-accusation. She thought she had had a miscarriage (unmarried) and was guilty of theft. This soon receded into the background, however, and the prominent feature of the content was henceforth that she was unable to say about what she worried and fretted. She claimed it was too vague, too hazy. That this was not merely a desire on her part to hide her ideas is shown by the fact that, after recovery, when she cooperated very well, she again stated that she really had not known at the time and did not

know now about what she had worried. In other words, after a few ideas of guilt elaborated as self-accusation in the first days, we find essentially a complete lack of formulation or focussing of any content associated with her distress. Something similar is found in Case 3. Before her state of perplexity the patient had gone through a condition characterized by anxiety, with ideas of self-accusation, plainly accepted accusatory hallucinations, and other depressive ideas. All these ideas referred essentially to the poor care she had given to her children or to the fact that her children or her husband had been killed. During the state of perplexity the patient was, for the most part, no longer able to state about what she worried, although an occasional repetition of her ideas of the first period was noted, when she said she was bad and had not taken care of her children, or she spoke of her children having been taken away. Therefore, here again is a shifting from what in a preceding state of anxiety had been clearly formulated ideas to an incapacity to state, for the most part, about what she was fretting in the state of perplexity.

Very different, however, are the last two cases, although Case 7 presents some features which at once show a relationship to the patients who constantly protested against accusations. A very frequent utterance of hers was, "I ain't done nothing," or "I ain't done anything to that girl" (a girl she saw on a stretcher while she was brought to Ward's Island on the hospital boat, and who, she thought, had been drowned). We have no evidence here of any accusatory hallucinations, but only indications of an indefinite feeling of being accused. Against this she protested. But the most prominent feature in this case was her frequent denial that she had anything to do with a lot of trivial incidents which happened about her, and which she felt had, somehow, something to do with her. There was also a constant desire to stop these occurrences. There was, therefore, a marked feeling of being responsible for many external happenings, which responsibility she, however, denied by saying she had nothing to do with them, while she also tried to stop them.

Patient 6 had, like a case of depression, some well-formulated ideas of guilt, partly in the form of self-accusation, partly in the form of accusatory hallucinations: "I stole from everybody"—"I have been in a bad house"—"Everybody says I steal things," or "I ought to be locked up in the Court House"—"I am no good, throw me in the river," and even after recovery the patient admitted having had ideas that she had stolen. But these phenomena were distinctly in the background, while in the foreground of the clinical picture, as in Case 7, stood a pronounced feeling of reference in regard to a great many trivial incidents and constant denials that she had

anything to do with them. Thus, when dishes were brought in, she said, "These ain't my dishes"; when something was said, "I didn't say that," or "I hear boats and whistles; I never lived on the water," or about something else, "That ain't mine," etc. Therefore, here again was a feeling of being responsible for external happenings and a denial of this responsibility.

In an attempt to see what is common to all these different types of content, we find that running through everything (where there is a definite content) is a depressive coloring. It is, moreover, much as in depressive states, in the nature of guilt. In the first place, we have repeatedly seen definite self-accusation which does not differ from that of depressive states, but which is always in the background in these perplexity reactions. But then we find what we might regard as a projected self-accusation either in the form of a feeling of being accused (Case 7 in regard to the death of the girl) or in the form of accusatory hallucinations (Cases 4 and 5). In all these instances, however, this accusation is not accepted, but violently protested against. Another form of projection consists of the peculiar ideas of reference which we find so prominent in Cases 6 and 7. Here the patient neither accuses herself nor do voices accuse her of anything specifically, but she feels guilty about a lot of trivial happenings in her environment; again, however, denying any responsibility in regard to them or trying to stop their happening. Next we find in Case 2 an example of the patient feeling wicked without being able to tell in what way she feels wicked, and in Case 5 its more projected counterpart of the patient feeling accused without being able to say of what she is accused. It seems to us that this leads over to the cases who were quite unable to say what they were fretting about. It is interesting that in Case 1, in which this was so pronounced, there was at first an expression of definite ideas of self-accusation which then vanished, and at the height of the perplexity the patient no longer could formulate what she worried about. In view of the general trend of these cases it hardly seems an unwarranted conclusion to say that the patient could not formulate her guilt. The same situation evidently existed in Case 3.

We seem justified in stating, therefore, that whereas in the depressive reactions there is frequently a feeling of guilt formulated in definite ideas of self-accusation, there is present in these perplexity reactions also a feeling of guilt, but it is dealt with in a very different manner, not to be sure uniformly, but in various ways which, however, all come to about the same thing. They are as follows: 1. The patient cannot formulate her feeling of guilt. 2. There is a projection of the feeling of guilt which finds expression in accusatory hallucinations which are not accepted or which are pro-

tested against. 3. The feeling of guilt may be projected and give rise to a marked feeling of reference in regard to many trivial acts. But here again the patient denies all connection with them or tries to stop them, or, in other words, does not accept them. It appears, therefore, that there is either no formulation, or when there is a formulation it occurs in the form of a projection and is not accepted. *Not formulated or not accepted guilt seems, therefore, to be the fundamental characteristic of the content of these perplexity states.*³

Now in our opinion it would be quite wrong to say that the content is the result of the perplexity, in the sense, for example, that since there is a certain disorder in thinking, anything like a clean-cut formulation of the content is impossible, even if we accepted such a possibility *a priori*. The very fact that in our cases the same result is reached in different ways speaks against such an assumption. It would, of course, be equally wrong to say that the perplexity arises because the content is not formulated or accepted. The same problem has repeatedly been discussed in melancholia, where the question was asked whether the patient was melancholy because he had depressive ideas, or whether he had depressive ideas because he was melancholy. The most reasonable attitude in all these questions seems to be to regard these various forms of mental reactions as units with a more or less definite and consistent symptomatology.

Considering that the content in these seven cases is so uniform, at least when analyzed as we have just done, it is evident that it forms an integral part of these perplexity reactions.

But so far we have taken up only the salient features of the content, and it is now still our duty to collect the loose ends. We may first consider the *feeling of reference*. We have seen that Patients 6 and 7 had this symptom to a very marked degree, and we have seen, how they elaborated it. The only other patient who also

3. After the article was finished we came across another case which undoubtedly belongs to this group, and the essentials of which should be added at this place because its content showed a slight variation from what has been described. The patient who had a pronounced distressed perplexity also had a decided disinclination to do anything (shake hands, go to meals, go to bed, come into the examining room, etc.), while at the same time he said, "I do not understand; everything I do makes it worse." In this case evidently the principle is not different. He felt that what he did was wrong, in other words, a feeling of guilt was attached to his own (trivial) doings. This throws some light on what we have called perplexity of action in Case 7, because in the present instance the situation is rather more transparent on account of the fact that the patient expressed a distinct feeling that his actions were wrong. To these cases who certainly showed something like negativism Bleuler's claim seems to apply, to the effect that the normal prototype of negativism is to be found in perplexity.

had a marked feeling of reference was Case 2. She claimed that every little thing had a meaning. This case, as was shown, did not elaborate this feeling in the same way as Cases 6 and 7. *Ideas of persecution* were present in two of the cases. Patient 4 spoke of many people being against her. Patient 5 said people wanted to get her out of the way; that somebody had spoken of the electric chair, or, she said, "You are going to hang me." It is natural that this symptom should exist in these two cases, because they are the ones in which accusatory hallucinations were most pronounced. Somewhat related to these ideas but fitting better into the setting of the case than would a direct feeling of persecution is the fact that Patient 7 often begged to be saved. There are a number of other ideas which are quite incomprehensible and evidently not characteristic, as they are isolated, such as the idea of Patient 1 that her eyesight would be ruined if she had a movement of the bowels, that the urine was coming from the wrong place, and the idea of Patient 2 that she had turned into two girls and had glass eyes all over. More comprehensible is the idea of Patient 6 who denied her marriage and her married name. We know from experience that this is not an idea which is in any way peculiar to these cases, but one which is very frequent in all sorts of psychotic reactions. It represents one of the fundamental and most common wish-fulfilments which arise from the fact that the adaptation to married life is inadequate.

We finally have to call attention to a set of ideas of which in the description of the cases we have spoken as belonging to the *sensory—unreality complex*. We know very little about the origin and significance of these ideas. In their most marked forms they are best known to us in anxious melancholias, more particularly those of the involution period. In a milder form they occur, for example, in more benign depressive states. Without, as we have said, knowing anything about their origin, it has always seemed to us that a certain relationship exists between: (1) The feeling that somehow the impressions of the outside world no longer call forth the same emotional response (expressed in the ideas that nothing makes the same impression as formerly, that no satisfaction is obtained from religion, that the affection for those formerly loved is lost, and the like); (2) the more marked feeling of unreality regarding the outside world and the patient's own body; (3) certain peculiar sensations; (4) certain of the so-called hypochondriacal ideas.⁴ All these phenomena are not uncommon in various states of distress, and it is not surprising that we find them now and then in the cases under

4. Hoch: A review of some recent papers on the loss of the feeling of reality and kindred symptoms, *Psychological Bull.*, July, 1905.

consideration, four of the seven cases presenting indications of them. Patient 2 said that nothing looked natural, everything looked alike. Patient 6 complained that all the days were alike, and retrospectively she said, "Everything looked alike; therefore I thought I could not see right." Patient 3 said her eyes were spoiled. All these are expressions which, as we often find, stand for the impression of unnaturalness which the outside world makes. Here may also belong the expression of Patient 4 that she was deaf and dumb, and her statement that her lips are dry, her blood is poisoned, that she never sneezes, never coughs, that her body is killed; very likely also the feeling of numbness of Case 6 and the idea, which undoubtedly expresses the same thing, that the blood does not circulate. Whether the ideas of Patient 4 that she is itching and has sores all over, that the womb is twisted, etc., also belong here, is hard to say. Of interest, too, in this connection is the fact that in Case 5 the perplexity commenced with such symptoms: "My whole system went crash, a heavy feeling came over my whole system"—"Something came over my whole system. My lips, my eyes, everything, my whole body. I walked as if I were in a trance, all in a quiver." This is not an infrequent beginning in cases of depression with an unreality complex.⁵ It represents what Janet has called a psycholeptic crisis.

In other words, in the minor ideas of these patients we have found nothing which seems especially characteristic of our cases. Some were incomprehensible, some we found to be natural enough in the setting in which they occurred, while those belonging to what we have called the sensory-unreality complex we are perhaps not surprised to find, because they are seen in other reactions of distress.

We still have to consider the second period of Case 6, and we had best do this here under the heading of content of psychosis. The condition of this period followed the state of perplexity already discussed, and preceded a hypomanic state, the only one observed in these cases. The elated mood which dominated the latter at times broke through in the condition we are about to deal with. This was evident from the fact that, in spite of the prevailing distressed mood, the patient could be made to smile rather readily by being smiled at or by funny incidents which happened around her. Indeed, even her own absurd remarks sometimes produced this. It is interesting in this connection to note that this second period differed essentially from the preceding one in the fact that, although there were accusatory hallucinations of the type with which we have already become familiar and

5. It also occurs with sudden onset of more marked symptoms in dementia praecox, as is well known.

which she denied, many of her hallucinations had a grandiose content. These she also denied. In the first category, that is, that which corresponds to the accusatory ideas, belong such things as her protests, "I never said anybody was bad"—"I never took any money"—"I never led a girl astray"—"I never gave anybody any medicine"—"I never talked French" (when she heard French spoken)—"I did not make that dirt" (when nurse sweeps)—"This is no whorehouse"—"Mr. Graham is not my brother" (when she heard graham bread spoken of). Here, too, should be mentioned some utterances in which she did not make denials in so many words, but her whole attitude and manner of speaking them denoted that she did not accept the accusations. This was the case when she said, "They say I catterize people" and "They say I am a dog." But in strong contrast to these were the grandiose hallucinations with their protests, "They say I live on \$100 a day—I have no money"—"They say I created the earth, that I have lots of money, that I have a yacht—I don't." We probably do not go far wrong if we consider this peculiar phenomenon, which occurred in a setting of an essentially "distressed perplexity" state, but in which there was also a certain undercurrent of an elated mood, analogous to the grandiose ideas which are sometimes uttered in transition stages between a depression and an elation, although it must be admitted that this does not bring us any nearer to an understanding of the condition.

CLINICAL POSITION OF THE CASES

In considering the clinical position of these cases, we must first state that we think we have plainly demonstrated by the foregoing analysis that they represent a definite reaction type. But we should nevertheless ask whether they have not some relationship with some of the larger groups of cases.

A. *The Relation of the Cases to Manic-Depressive Insanity.*—In order to make clear our attitude in regard to these classificatory questions, we would say that we do not consider manic-depressive insanity in the light of a "disease process" but as a group, most frequently of constitutional reactions in the form of affective psychoses, that is, psychoses in which most of the clinical pictures have essentially the symptomatology of the emotions.⁶ Now have we any reason to regard these perplexity cases as having some relationship to these psychoses? In this connection we have to recall, first of all, that Kraepelin in his textbook speaks briefly of perplexity arising in manic-depressive

6. This does not cover all the clinical pictures, because the benign stupors also belong here, since the internal relationship with the more characteristic manic-depressive psychoses is shown partly by transition forms to them, partly by combinations with them in the same persons at different times.

depressions when the thinking disorder reaches a certain intensity. This might, of course, simplify the problem very much. It might mean that these cases are depressions with a thinking disorder sufficient to bring about a perplexity. However, to our mind it is very questionable whether an increased thinking disorder such as the one which we find in manic-depressive depression ever can produce a perplexity. It must be admitted that *a priori* it seems not improbable that an interference with the intellectual processes may produce perplexity. There naturally come to our mind the experiences in certain sensory aphasias in which we may see something like a perplexity, or some grave forms of arteriosclerotic deterioration which also present a certain perplexity at times. But that, of course, does not necessarily mean that the specific interference with the intellectual processes found in depressive states is also capable of bringing about the same result. We have seen that in our cases we are not dealing so much with an actual confusion as with a "subjective sense of confusion," and it is not likely that an increased thinking disorder would produce only a subjective sense of confusion. Above all we have shown that the perplexity reaction is one which is so characteristic in its different aspects that it seems much more natural to regard it as a unit in which the perplexity, the affect of distress, the peculiar content, all are an integral part of the whole reaction without there being any primary or secondary symptoms. For these reasons we would reject Kraepelin's hypothesis for our cases, just as we have rejected the hypothesis of Bonhoeffer. Hence it is clear that from this point of view we cannot assume any relationship with manic-depressive insanity.

But we may, perhaps, approach the problem from the point of view that the reaction of distressed perplexity is not unlike one of the emotional reactions which we see in daily life. A situation may give us joy or sadness, it may give rise to anxiety, anger, etc., but it may also perplex us. Unfortunately the symptomatology of these various normal reactions has, so far as we are aware, never been worked out, and it is difficult to say directly whether our cases would correspond to a normal perplexity, but we can assume at any rate that distressed perplexity is a normal emotional reaction. From this point of view, therefore, there is a certain justification in regarding our cases as related to manic-depressive insanity. But we have, as a matter of fact, also other evidence which speaks in favor of this assumption: (1) We have in the analysis of the clinical pictures shown certain points of relationship to manic-depressive reactions (the thinking disorder, the disorder of the train of thought). (2) Most cases are benign, that is, do not lead to deterioration. (3) We find that two and possibly three of our cases belong to manic-depressive families. This is fairly clear in Cases 1 and 2; the former patient had a sister

and a brother who each had a depression followed by recovery; the latter's father had a melancholia in advanced years, while her sister had a "nervous breakdown." Here we may perhaps also add Patient 3, whose brother had an attack of insanity from which he recovered. (4) Some of the patients had former attacks from which they recovered completely, namely, Patients 2, 6 and 7. In Case 2 we cannot tell what the attack was like; Patient 6 had an earlier attack after childbirth which began with "feeling blue"; then she complained of noises in the head, seemed to take no interest in anything and laughed in a silly manner. It is obvious that with these meager data the condition, too, is difficult to interpret retrospectively. We must admit, however, the possibility of a so-called mixed manic-depressive attack, especially since we have seen "mixed features" in the attack under observation which was, moreover, followed by a hypomanic phase. Patient 7 had an attack which in many ways (to judge from the few notes available) seems to have been like one of distressed perplexity. She was restless, distressed, affirmed that she had done nothing wrong, and in answer to questions, often said she did not know. Hence three of our patients had former attacks from which they recovered. In one of these we have not enough data to judge of the nature of the attack, in another we have some reasons to regard it as a mixed manic-depressive condition, while a third was very probably also one of perplexity. (5) More important is the fact that when Patient 1 got well she went through an unmistakable depression with the feeling of inadequacy ("I can't make up my mind to act"—"I lost my will power"), so typical of manic-depressive depressions, and a marked feeling of unreality ("Things don't seem quite real"—"affection for family diminished"—"don't feel hunger, heat or cold as I used to"), which is also not infrequent in these depressions. Moreover, this case commenced like a depression. Then again, Patient 6 had a depression before the perplexity came on, while before her recovery she went through a hypomanic state, and the second part of her perplexity phase presented, as we have seen, certain manic features. Perhaps, too, the fact is of importance that Patient 3 first went through six weeks of an essentially affective reaction. (6) Finally, we have seen that we probably have to regard the ideas of self-accusation present in some cases as representing transition features to manic-depressive depressions. We see, therefore, that a certain internal relationship of these cases to the manic-depressive group actually does exist.

Here, perhaps, is the place where Case 3 should be separately considered.

Unlike what we found in the other cases, the perplexity here lasted much longer, and after more than two years the patient has not yet recovered. It is reported that there is still a certain perplexity.

but also a good deal of inactivity without any real apathy, however. Evidently her affective reactions are still quite pronounced and are easily aroused when the topic of her children or her home is touched. Then she is apt to cry. It should be emphasized that there are no schizophrenic symptoms. In regard to the inadequacy of some of her answers, it is well to remember the remarkable difficulty which we found, especially in the anxious state of this patient, in getting correct answers regarding many data of her life and her orientation. We emphasized then her evident illiteracy and her probably low mental level. It is probable that the present difficulty may largely be due to the same factors.

The meaning of the long duration of her state is difficult to understand, but we are certainly not justified in regarding this case as belonging to the group of dementia praecox. It would seem wiser, therefore, to leave open the question whether it belongs to a larger group, and to be satisfied with what it has furnished us for the general consideration of perplexity and with the facts as they stand.

B. The Relation to Toxic-Infectious Psychoses.—There is unquestionably a certain looseness in the conception of the toxic-infectious psychoses. For that reason it is a great merit of Bonhoeffer² to have attempted to bring some order into this topic. This he has undoubtedly done, although there is still much work to be accomplished. Thus, it seems to us that not enough consideration has been given to a differentiation, from other reactions, of those types which are apt to be associated with neurologic symptoms and which have the symptomatology of the typical organic deliria. But Bonhoeffer has at least shown us certain more or less definite pictures which are apt to occur in toxic-infectious conditions. These are, among others, the Korsakoff pictures and the organic deliria. But there is also a much vaguer field of cases which are called amentia. These amentias may present typical manic features and many manifestations of "catatonia" are common in them. It is consequently not remarkable that features of perplexity should also occur at times.

We will here quote two cases which are called amentia by Bonhoeffer,² and which show the existence of perplexity traits, not in pure clinical pictures such as we have here described, but with sufficient clearness, we think, to enable one to recognize them as related to the reactions which we have outlined, and as will be seen, they are cases with a definite toxic etiology.

The first is his Case 17, a woman who had a fever of doubtful etiology for four days. With the fall of the fever there was sleeplessness, restlessness, speaking little, refusing food, and she spoke of wanting to kill her husband. On the fourth day after the onset she was sent to the clinic. On the way she was quite excited, beating about and spitting. Under observation she was found

weak, with little motion, and almost mute. Attempts to put her in a bath produced anxious excitement in which she appeared to be completely disoriented. She also heard accusations and kept protesting against them. The mute condition was at times interrupted by talkativeness in which she talked of family affairs and former experiences, and was distractible. Toward evening there was delirious grouping. Next day she was perplexed, surprised at everything, called the doctor and then had nothing to say. Retrospectively, she said that her anxiety began when she was transferred to the clinic, and that in the clinic she thought everything referred to her.

It is unquestionable that here certain traits, at any rate, are like the cases which we have heretofore described — notably, aside from the perplexity, the ideas of reference and the accusatory hallucinations with constant protests. If there was a complete disorientation, this, as well as the delirious groping, would denote features of another reaction.

The next is Bonhoeffer's Case 25. It is a chorea psychosis in a girl of 21, in which a state of perplexity also occurred episodically. For some months before the onset of the psychosis the patient complained of headache, sleeplessness, took everything to heart, was irritable and could not concentrate. Then she began to cry, thought others said she was not working enough, began to make incomprehensible remarks and finally had a peculiar attack with turning of the eyes, twitching of the whole body, grimacing, and foaming at the mouth. Under observation it was noted that she had a marked chorea. There were auditory hallucinations and ideas of reference. She was oriented, able to give an anamnesis, but had difficulty in concentration and made an occasional irrelevant remark. Her mood varied from euphoria to depression. At night she slept badly, saw faces on the ceiling, suddenly jumped up and called fire. With increasing chorea there was disorientation with dreamlike hallucinations for a few days. She saw heads, devils, animals, the emperor, had ideas that she had been on an express train, had fallen out of the window, had been in Berlin. With this she was distractible, talkative, flighty; a certain insight was present, and the patient herself spoke of being delirious. She complained of great heat. After six days she became very quiet; there was reduction of spontaneous activity; all answers were slow except simple ones. She now could no longer give data which she knew at first, was no longer able to read the watch, count backward, or count money. In naming objects there were some flighty replies and some totally wrong ones (nose-horse). Some apraxic reactions were present, such as straightening out of body when told to raise herself up, or straightening out of legs when told to get up. Ten days later she was mute, anxious, inaccessible, hallucinating. Later she was still monosyllabic and somewhat surly. When better she talked about dream fancies she had had, pistol shots she had heard, said she thought she had been in a cemetery. Then she developed *restlessness with numerous utterances denoting perplexity, saying she did not know what was going on, what things meant, also had a facial expression denoting perplexity, there were ideas of reference, slandering hallucinations, calling her prostitute, and the like.* This perplexity was evidently transient, but for some time after, the hallucinations and ideas of reference with good orientation continued. After this she recovered.

Here then we again have a perplexity which shows a number of characteristic features, as an episode in an otherwise different clinical picture, the whole arising on a toxic-infectious etiology.

We see, then, that features of this picture, like features, for example, of the manic and stupor reaction, may, with others, arise on a toxic-infectious etiology, but we also know that the latter two may occur in pure form on the basis of such an etiology, and it is therefore *a priori* not impossible that the same may be true for the perplexity reaction. The first diagnosis in Case 4 which was made was that of a toxic-infectious psychosis. The recent childbirth with some fever following, the tendency to subfebrile temperature, together with dry lips and coated tongue during the first part of the observation spoke for this. It was also thought that the peculiarly incoherent talk, the apparent interference with the orientation and the hallucinations pointed to it. We now know that the mental symptoms are characteristic of a distressed perplexity reaction and not of a more typical toxic-infectious psychosis, but from what has already been stated, it is by no means excluded that a toxic-infectious etiology may have had something to do with bringing about the psychosis. For a further elucidation of the clinical position of this case the condition which followed the perplexity unfortunately does not help us. She first presented for several months a peculiar, atypical, rather disgusted depression, with reduction of activity, but ability to speak promptly and with the ideas that she was disgusting, rotten inside, covered with feces; that she had no body, no eyes, no teeth, etc., a condition which was associated sometimes with a fetid diarrhea and throughout with loss of weight and physical exhaustion. Next came a condition essentially of languor. It is possible that these states, too, may have had an essentially toxic-infectious etiology. They certainly are not specially characteristic of a manic-depressive reaction, in contradistinction to some of the other cases in which we have shown that the perplexity was either preceded or followed by typical manic-depressive states.

C. Relation to Dementia Praecox.—We finally have to discuss the relationship of our group to that of dementia praecox. This is demanded by the fact that we consider Case 5 to be fundamentally a case of dementia praecox. We must begin by stating why in our opinion this diagnosis must be made. In the first place, the fact may be of some importance that early in childhood and again since her marriage she wet her bed and had fainting spells. This may denote a degree of lack of adaptation, especially to the marriage situation, which may tend toward a dementia praecox constitution. The perplexity state itself was in its essentials not different from that presented by the other cases. We have, however, already called attention

in the description of the case to a few features which even at that time looked somewhat ominous. Here should be mentioned her statements that her mind was taken off and that she was hypnotized. Although such utterances may occur in benign states, the feeling of passivity which they denote has a certain praecox flavor to it. The same may be said about a peculiar reaction shown in the midst of her distress when she was questioned how many children she was accused of having, and she said, with considerable laughter, "A small orphan asylum, I guess. I guess they thought I had them like chickens." Then again her shameless masturbation in the period following the perplexity was suspicious, as were also the retrospective falsifications when there was no longer any perplexity. Even more convincing than all these traits was the terminal state. She was self-absorbed and slovenly, had sudden outbursts of laughter which she motivated in a typical schizophrenic manner: "I think of funny things," and when asked to explain, "I see in the paper 'Hoch der Kaiser,' but I don't like Germans; suppose some one does a mean trick and you say 'Hoch der Kaiser' to get back at them." Again, we must mention the incomprehensible hallucinations in a setting of general apathy: "Some one said pails of jelly, seventeen cents, my father paid for them," or "Some one said foundling asylum; I did not come from foundlings." Also the sexual hallucinations in the setting in which they occurred: She claimed a lot of "smut" was talked and she added, "I am kept here for the filth of social aristocracy." (What do you mean?) "Does not socialism mean free love?" Then again we have the spells of sudden screaming and attacking others, which without obvious external reasons were found later in her psychosis, as well as the total lack of insight when she was finally discharged "without recovery," and the fact that she was not willing to go back to her husband. Perhaps one more feature should be mentioned which seems to us to be a typical schizophrenic manifestation. At one time she said to the nurse that she could have her husband, and when confronted with this she said "No, you can't have him, he never hurt any one. It is G. you mean." Again, "There are two S.'s" (the name of her husband). Especially in view of the fact that, as we found later, G. actually went under two names, this shows a peculiar identification of two persons which we have frequently met in dementia praecox and which we are inclined to regard as rather characteristically schizophrenic. We see this phenomenon even more definitely in the episode when she mixed up the identity of the woman who three years before had given her silver which did not belong to her with the woman from whom she was supposed to have stolen the towels. Speaking of Mrs. D. (the woman who had given her the silver which she claimed was hers, but which in reality she had stolen) she said, "She gave me the towels and said she paid for them." There

are, then, many points which speak for dementia praecox in this case. It is scarcely necessary to add that the fainting spells which occurred during this patient's earlier life need not raise the question of epilepsy.

But *in spite of the fact that we have to regard the case as one of dementia praecox, the perplexity reaction as such differed in no way that we could state from that of the other cases.* This is, after all, not a new experience. We know, as we have already said, that in the case of manic as well as stupor reactions which occur in this soil it may be impossible to differentiate them from the same reactions when they occur in a benign setting, although there are frequently symptoms which are characteristic enough. It is another evidence that these states of distressed perplexity represent a typical mental reaction type, and we see now that, like some other such reaction types, it may occur in various settings. We have given evidence to show a certain relationship to the so-called manic-depressive reactions; we have shown that something like it, at any rate, may arise on a toxic-infectious etiology, and we have now demonstrated that it may occur in the course of a deteriorating disorder of the type of dementia praecox.

FURTHER CONSIDERATION OF ETIOLOGY

In spite of having touched on the question of the etiology of these cases before, it is well to devote a few words to some further considerations of it. Since three patients had former attacks, this represents for them at least a certain evidence that they arise on a constitutional basis. This would also be suggested by the fact that several belonged to families in which insanity had occurred in other members, as well as by the fact that there is a certain evidence in some of the cases showing a relationship to manic-depressive insanity. We have, however, also seen that in Case 4 a toxic-infectious etiology may play a rôle, and in Case 2 it is claimed that after a fatiguing care of the husband the patient had an "influenza," and that she soon began to be sleepless, subsequent to which the psychosis commenced. Unfortunately, no details are known about this "influenza," and therefore we cannot be certain whether it was not simply the beginning of the psychosis.

In constitutional disorders it is always an interesting question to look into the precipitating mental causes, and it seems that here we have, at least in some cases, some not uninteresting facts. Case 3 had a fight with her sister-in-law a week before admission. During this the latter pulled her hair and the patient fainted. Then the sister-in-law and some other woman threatened the patient with reporting her to the board of health and the charities department for not keeping the house clean (she was janitress). They also told her she would have

to go to the state prison. This was repeated a few days later. At that time she fainted again. The perplexity did not come on at once, but was preceded by a state lasting six weeks which was characterized chiefly by anxiety.

Patient 5 was told eleven days before admission that she was suspected of having stolen towels (she was innocent). This at once upset her and in a short time was followed by a state of perplexity. It is interesting that according to the patient the later statement by the woman from whom she was supposed to have stolen the towels to the effect that she had not suspected her, made no difference; in fact, the patient said, "Then I got depressed without knowing why."

Patient 6, two months before admission, was falsely accused by her stepmother of having stolen some things from the house. It is said she turned pale. She at once became dazed, complained of feeling dull, later said she felt her memory going. She then seems to have had a depression with, for a time, reduction of activity and essentially depressive ideas, all of which lasted about two months. Then followed the perplexity.

Patient 7 was told two months before admission that there was gossip going on about her former life (having children by her later husband before marriage). She worried about this, but did not get abnormal. Six days before admission she had a scene with the girl who was chiefly responsible for the gossip. Of this, unfortunately, no details are known. She was at once abnormal and soon became perplexed.

It is, in the first place, rather striking that in four out of seven cases there should be such obvious mental precipitating causes, and in the second place, that these precipitating causes all show a certain similarity, since all of them represent accusations. We shall not try to go into any explanation of this, but merely conclude that accusations seem to be frequent as precipitating factors of these perplexity states, but that the perplexity does not always arise immediately, but may first be preceded by another form of reaction.

Prognosis.—It is of some interest that the general duration of these cases is not long. Two cases lasted ten days and two weeks, respectively; four cases lasted from six weeks to three months. In this group is included the case of dementia praecox, but of course only the phase of marked perplexity is taken into consideration. One case (3), which is somewhat difficult to interpret, lasted much longer. With the exception of this last case, therefore, there seems to be a tendency for these perplexity states to be of rather short duration. That of course the prognosis is not only influenced by such considerations, but must be guided by the facts of the entire case, is shown most prominently in Patient 5, who deteriorated as a dementia praecox.

CONCLUSIONS

We have tried to show by an analysis of seven cases of distressed perplexity that these attacks represent a *definite reaction type*, because, in spite of certain differences, the cases are remarkably uniform. This uniformity was shown in the following features:

1. They all showed perplexity in their facial expression and in their utterances. The latter denoted a feeling of being mixed up which referred essentially to being mixed up about the environment. Although orientation questions were often answered by the patient to the effect that she did not know, or by replies which seemed to denote a definite incapacity to understand the environment, it was found, on further analysis, that answers could usually be obtained which were much better than one was led to expect at first. Therefore, the trouble seemed to be more a subjective sense of confusion than an actual persistent incapacity to elaborate impressions.

2. All cases showed marked distress. In four this was associated with constant, in one with episodic, restlessness, while in two with phenomena of inhibition. Among the restless cases two patients showed a difficulty in thinking, which may be closely related to that of manic-depressive depression. In two others in whom the restlessness was associated with talkativeness, there was a striking disorder of the train of thought which consisted in poor arrangement of the sentences, unfinished sentences, the tendency to pick up the theme at a different place, and repetition. This was regarded as on a par with other disorders of the train of thought in psychoses with marked affective changes, such as those of the manic or of the anxiety states, and therefore as psychologically not unexpected on the basis of the entire distressed perplexity reaction. Among the inhibitory phenomena present we found in one of the two cases mentioned something also akin to the retardation of movements and thought found in manic-depressive depression, but it was associated with negativistic traits (resistance + refusal of food and retention of urine). The other case showed constant alternations between agonistic and antagonistic impulses which, in contradistinction to Bonhoeffer, who regarded such phenomena as the cause of perplexity, were here judged to be an integral part of the reaction without endeavoring to explain why it occurred in only one case.

3. The content of the psychosis showed, in spite of superficial dissimilarities, a remarkable uniformity. It seemed that, just as in depression, there is an underlying feeling of guilt which is, however, dealt with in a manner totally different from depression. This manner of dealing with the feeling of guilt is not uniform, but differs in different cases, though on analysis the different forms were shown to come

to the same thing. They are as follows: (1) The patient cannot formulate his guilt. (2) The feeling of guilt is projected and finds expression in accusatory hallucinations which are protested against, that is, not accepted. (3) The feeling of guilt may be projected in the sense that the patient has a feeling that many trivial acts in the environment are wrong and that he is responsible for them; he denies all connection with them or tries to stop them; hence here again no acceptance. In still another type the patient has a guilty feeling about his own acts and consequently hesitates. It appears, then, that either there is no formulation, or when there is a formulation it occurs in the form of a projection and is not accepted. Not formulated and not accepted guilt seems, therefore, to be the fundamental characteristic of these perplexity states. Other parts of the content were much less characteristic and less prominent. They were isolated or readily comprehensible through their setting. The latter was the case with some ideas of persecution in the cases with many hallucinations, and with the ideas referring to the "sensory-unreality complex," which also occurs in other reactions in which there is considerable distress; or with the hallucinations of a grandiose character (protested against by the patient as she protested against having anything to do with the trivial occurrences mentioned) which were accounted for on the ground that manic features had entered into the clinical picture at a certain point.

4. As to the clinical position of these cases, it was shown that the reaction as such has a certain relationship to the manic-depressive reactions, that features of it, and possibly the pure clinical picture, may occur on a toxic-infectious etiology, and also that in its typical form it has occurred in a case whose further course was that of dementia praecox. It was pointed out that the same is true in the case of the manic and the stupor reaction.

5. It was shown that the reaction as such seems to occur most often on a constitutional basis and that plain mental precipitating causes are found with uncommon frequency (four cases out of seven), and that those found show a certain uniformity in that they all were of the nature of accusations.

6. Finally, it was pointed out that since in six of the cases the psychosis lasted from ten days to three months, this reaction seems, as a rule, to be of shorter duration than those, for example, of the well known forms of the manic-depressive type. It was also shown, however, that a more protracted course may occur.

PERSONALITY TESTS INVOLVING THE PRINCIPLE OF MULTIPLE CHOICE

ABRAHAM MYERSON, M.D.

Assistant Professor of Neurology, Tufts College Medical School; Chief Medical Officer, Outpatient Department, Psychopathic Hospital

BOSTON

On the capacity to choose between competing stimuli, ideas and purposes rests the fate of the personality. Throughout life the choice lies not between absurdity and truth, reality and unreality, but between the various degrees of better and worse, between ideas or purposes which may be said to represent different points of view, different attitudes, rather than any more fundamental difference.

Despite this fact, in the tests used in psychology and psychiatry, the question of choice, as between different phases of reality, is not studied. The Binet tests, which measure intellect, usually deal with simple problems to which only one correct answer can be made. In this respect they resemble the ordinary examination paper, and have for their paradigm the mathematical answer in which choice, at least in elementary mathematics, does not enter. Most of the situations in life, as has been stated before, in which personality and character appear in evidence, are solved in a manner roughly to be compared to situations involving beauty, that is to say, the answer is often a matter of taste, many choices are possible, and therefore many answers. What comes to the front are attitudes, personality trends, decision and reasons for decision.

In order to reach toward the factors of choice I have devised the method which I call the "Method of Multiple Choice." Incomplete situations are presented to the subject, and he is given his choice of certain completions, any one of which represents a point of view, an attitude of the personality, perhaps only an opinion. Whether one or the other of these completions is correct remains a matter of opinion, but it is certain that in the time taken for decision, the vigor of choice, the side remarks made in choosing, the tolerance and intolerance toward the other points of view, and the capacity of defending the point of view taken, a quick insight into the opinions, the trends, and perhaps into the essential character of the individual is possible.

It is not my intention in this paper to take up in detail the results of the tests, or to describe all the tests I have been using. *The general method* is the subject of this paper, and in order to elucidate it I shall describe one or more of each of three series of tests, each series having a different purpose, and each of the tests

specializing in the effort to elicit specialized attitudes of the individual. It is my belief that the method has great value not only in the testing of normal persons, but perhaps still more in the examination of the abnormal—that is, the psychopathic; the psychotic. Further extension into other fields will be indicated not as the result of work done, but as a thesis to be developed by others.

SERIES I — TEST I

A large card, as shown below, is made with three printed lines and three blank lines alternating. The three blank lines are to be filled in from the slips of choice, which are merely long pieces of cardboard arranged opposite the card. Any one of the first group of slips of choice, four in number, fits the first space; any one of the second group, also four in number, fits the second space; and so any one of the third group, of the same number, fits the third space. The three lines to be chosen are to represent what the subject believes to be nearest the truth as he sees it.

CARD	SLIPS
1. The man who lives a pure life	{ <i>Will miss a lot of fun.</i> <i>Will gain the respect of all.</i>
2.	
	{ <i>Treads a difficult path.</i> <i>Will be cheated by rogues.</i>
3. As he reaches old age.....	
4.	{ <i>He will regret untasted pleasures.</i> <i>He will be serene and wise.</i>
5. After he is gone.....	{ <i>He will still meet with temptation.</i> <i>His children will want bread.</i>
6.	
	{ <i>He will be a long time dead.</i> <i>His memory will be honored.</i>
	{ <i>His struggles will be ended.</i> <i>He will fill a pauper's grave.</i>

For example, a typical story will read:

1. The man who lives a pure life
2. *Will gain the respect of all.*
3. As he reaches old age
4. *He will be serene and wise.*
5. After he is gone
6. *His memory will be honored.*

Lines 2, 4 and 6 have been selected from the slips of choice to fill in the blank places; thus a coherent story has been made, the added lines are in harmony, there is no crossing from one group of ideas to another, and the whole stands as a point of view.

As technic I lay out the card with the slips opposite, and each of the three groups of slips opposite each space (it makes the tests almost too complicated to mix up the groups so that a slip which belongs in Line 6 is opposite Space 2; however, aside from the

fact that the cards correspond to a space within the group, I usually arrange the slips so that corresponding ones do not stand in corresponding places in each group). I then say to the subject, "This is a story with three lines missing. Any one of these four slips (indicating the first group) belongs in place of Line 2; any one of these (indicating the second group) belongs in place of Line 4; and any one of these (indicating the third group) belongs in place of Line 6, and ends the story. Fill out the story as you believe to be the nearest the truth."

It will be noted that the slips fall into four groups telling different stories: one which I call the *conventional* is—"the man who lives a pure life will gain the respect of all; as he reaches old age he will be serene and wise; after he is gone his memory will be honored"; the second, or *naturalistic*, is—"the man who lives a pure life treads a difficult path; as he reaches old age he will still meet with temptation; after he is gone his struggles will be ended; the third, or *cynical and humorous*, is—"the man who lives a pure life will miss a lot of fun; as he reaches old age he will regret untasted pleasures; after he is gone he will be a long time dead"; the fourth, or *pessimistic*, is—"the man who lives a pure life will be cheated by rogues; as he reaches old age his children will want bread; after he is gone he will fill a pauper's grave." While these are, as it were, separate stories representing different points of view a subject may cross from one to another, as is often done between the conventional story and the naturalistic, for example—"the man who lives a pure life will gain the respect of all; as he reaches old age he will still meet with temptation; after he is gone his memory will be honored." The underlined words belong to the naturalistic story, but have been incorporated by the subject because it expresses his point of view.

Then I tell the subject, "Now arrange the other stories in order of your choice, or their acceptability to you." Some will say, "I don't accept any of them"; others may accept one or two, and still others will accept all, and arrange them in the order of their merit and acceptability. If a subject refuses to accept certain stories I take the first slip belonging to the story, place it in the space and say to him, "Now fill out the rest of the story as if you accepted it." To some this presents no difficulty, to others there seems to be an obstacle mentally toward the completion of the unwelcome or unacceptable.

The conventional, optimistic story is perhaps the most common choice among the group of people I have studied (physicians of the Psychopathic Hospital, psychologists, social workers, other normal people of rather high intelligence, and an occasional patient). Next

in order of frequency is the realistic or naturalistic (treads a difficult path, etc.); this is almost always accepted by scientific workers as their first choice. More rarely, but not infrequently, is the cynical, comic (will miss a lot of fun, etc.). Very rarely, indeed, is the pessimistic (will be cheated by rogues) chosen as the first in order of acceptability. The reactions of the insane to the tests are very interesting, but, as has been stated before, this paper is not concerned primarily with the results. It may be stated that what can be ascertained are: (1) the method of choice—for example, some persons use the trial and error method, others deliberately survey the whole field, mentally arrange all the four groups before taking a single one, and between these two groups all intermediate types of choice are shown; (2) the time of choice, which varies from the very slow reaction of those who show tremendous blocking to those who are exceedingly quick and certain in their choosing; (3) the firmness of decision or resistance, which is manifested both by the manner of picking up the slips and by the comments of the subject; (4) the trend of opinion (conventional, naturalistic, cynical, comic and pessimistic); (5) the catholicity of opinion (that is, the ability to find all of these choices acceptable in part at least); (6) often the history of the patient and his life experiences are revealed in the comments and what I call the externalized introspection of the subject as he chooses. Together with the other tests of these series a very interesting and quick orientation into opinion is reached. Many subjects are extremely anxious to debate the question of their opinion with the examiner. This, of course, is not encouraged.

SERIES II — HUMOR TESTS

In this series the attempt has been made to arrange a series of jokes, witty stories, satires, fables, etc., which shall test the person's capacity to select the "point" out of the material presented. A humorous story is presented up to just before the "point" and then a series of endings is presented from which the subject is to conclude the story. I call these series "constructive humor tests," realizing, of course, that humor (used as a generic term for the comic and the witty as well as for pure humor) is a matter of situation and mood, and may be lost by being approached as a problem. In selecting the tests of a Series I had in mind the fact that strong contrary feeling aroused by a story destroys the feeling of humor; for example, if a story reflecting on Catholicism be told to a Catholic, anger is the result rather than laughter—similarly, the German people would probably not enjoy the current jokes on the Kaiser, and obscene jokes will shock rather than amuse a modest woman. *The tests then offer a means of reaching complexes, but I shall not insist on this purpose of the tests here.*

SERIES II — TEST I

A simple play on words (from Freud).

CARD

Two men met outside of a bathhouse. Said one to the other, "Have you taken a bath?"

"No," said the man addressed—

.....

SLIPS

Have you?

Why should I?

It's not New Year's yet.

Is one missing?

The original joke read: "Two men met outside of a bathhouse — said one to another, 'Have you taken a bath?' 'No,' said the other, 'is one missing?'" This, of course, is a play on the word "taken," and the naïveté of the man taking the unfamiliar use of the word "taken" in connection with a bath betrays his unfamiliarity with bathing, and his possible connection with stealing. We may safely assume that he does not often bathe, and that possibly he steals.

Of the other answers given, "It is not New Year's yet," refers to the chestnut, "I take a bath once a year whether I need it or not." This is frequently chosen as the proper ending for the story. Strange to say, so are the other two endings — "Have you?" (which is entirely pointless, or else impertinent) — "Why should I?" (which is merely simple or foolish). There are persons who see the "point" like a flash, others have great difficulty in deciding, and these usually pick the wrong answer. Almost every one sees the "point" once the word "taken is emphasized to them.

SERIES II — STORY IV

CARD

Voltaire and an Englishman decided life was made up of more pains than pleasures, and that it had no purposes that man could see, and nothing to justify the suffering. They therefore decided to commit suicide together.

On the next day, and at the place appointed, the Englishman appeared, but no Voltaire! After looking high and low the Englishman went to Voltaire's house. There he found the sage seated at a table set with a delicious meal and reading a naughty novel with very evident enjoyment.

"But," said the Englishman, "This is the day we were to commit suicide."

"Oh," said Voltaire, "That was yesterday"—

.....

SLIPS

Today I feel well.

Today my digestion is good.

Today my bowels moved freely.

Today I am happy.

Today I see that suicide is sin.

The original story ends, "Aujourd'hui j'ai bien opéré," which is here translated—"Today my bowels moved freely." The point lies in the homely observation that unhappy mood and philosophical pessimism often depend on an overloaded colon. This belief is often expressed in crude language all over the world, but its relation to pessimistic philosophy is very neatly put in the story. The Englishman with his insistence on keeping an appointment emphasizes the humor of Voltaire with his easy transition from pessimistic philosophy to care-free enjoyment of the good things of life.

Most people, however, avoid this ending, either through disingenuousness or esthetic prudery. "Today my digestion is good" suits them better, but this answer lacks the direct and pungent humor of the original, and is an euphemism. Those lacking in humor select, "Today I feel well"—or, "Today I am happy," which, of course, explains why Voltaire did not keep the appointment for suicide, but carries no surprise nor brusque wit with it. Only one person selected the slip, "Today I see that suicide is sin." This person stated that for Voltaire to use such an expression would in itself be a joke.

(In seeking for a method to estimate the constructive humor of the individual I have in mind that pictorial humor is an essential form. I have devised tests for that purpose, but up to the present time have not been able to obtain the artistic skill which is necessary. What is needed is a picture with one part missing—that is, one figure, or person or thing—and to allow a choice of figures, persons or things, all of which fit, but not all of which are humorous.)

As material I have used the story of the peasant who asked for death, and when the monster appeared asked him to help him on with his load of wood; the malicious, and almost obscene, joke in Freud about the prince who made insinuations about the virtue of the peasant's mother and the retort which crushed him, and other stories ranging from pure satire (such as Bjornsen's story of the satirist who was killed by his friends)—to the choice absurdities of some of Mark Twain. It is remarkable how quick some minds are at selecting the point from the various types of answers given, and it is equally remarkable, though quite pathetic, how others miss it entirely. One might write a humorous book about what people think is humor. On the whole, the results of the tests correspond to the reputation that the individual bears in most cases; nor does it seem as if there were any great difference in the sense of humor of men and women, except that women have a more restricted field in which they are *allowed* to find humor. That is to say, public opinion and training conspire to inhibit through modesty, and similar feelings, the explosion that attends the risqué, the obscene, and the too daring.

It probably has been noted that the form of the humor-choice tests is different from that of the first series. This is because it was found that there was too great a limitation placed on the field of the tests by restricting the form to that of the interrupted story, and that it was possible to present a more coherent and concrete situation by the plan of telling a story up to just before its very end and climax. This plan was followed in the next series of which two examples are here given. This series deals with situations in which the ethical standards of the individual are involved by his choice of a completion.

SERIES III — STORY A — ETHICAL TESTS

CARD

SLIPS

A man discovers that the one he believed to be his best friend withheld information from him some time in the past, which resulted in his losing a fortune and to the financial advantage of the friend. Now he receives information which if he transmits it to the "friend," will enrich the latter, but which if he does not, will ruin him.

He withholds the information.

He transmits the information.

He transmits the information on condition that the other first make restitution.

The subject is told, "Here is a story told without the ending — on these slips are endings; choose the one first which is nearest to what you consider the ethical or ideal answer to the problem of the story, that is, choose what one *should* do in such a situation. Second, then choose what you think you would do, whether it is ideal or not. Third, what do you think the majority of people would do."

As will be seen, the answers to the problem here advanced indicate: (1) revengeful conduct; (2) forgiveness of a thoroughly "Golden Rule" type, and (3) compromise conduct. Many of the subjects point out in all the ethical tests, "You can't tell what you really would do in real life." Of course, life is different from any test, yet as a means of eliciting earnest opinion and debate this method, especially in these ethical questions, gives quite remarkable results. Warmth of opinion is always manifest, and, as has been before stated, the attitudes, the little speeches which burst extemporaneously from the lips of subjects, the evidences of doubt and indecision are illuminating and interesting.

Most people find it easy to say to transmit the information in the problem is the proper conduct, that is to say, the thoroughly "Golden Rule" conduct is proper, but of these the majority pick out as *their* conduct the compromise — that is, the one in which the man that has

been wronged makes a deal with the other. They feel themselves too weak to practice such lofty ethics, and do not seem particularly ashamed of it. In other words, what is inferred is that the ethical conduct is too lofty for human capacity. A lesser number deliberately say that they believe it to be better ethics to force restitution—they reject the idea that compromise with some ethical ideal is involved, what they wish is restitution, the punishment of the guilty, and this they say redounds to the good both of society, and the two parties involved in the problem. One man went so far as to state that the ethics of the "Golden Rule" was not only impracticable, but that it was wrong, that punishment of the guilty is necessary for the guilty man as well as for society. To condone the wrong by giving freely to the man would have led the way for the complete demoralization of the man's character. The majority of these people, that is, those who believe that the compromise is indicated, do not believe in any rigid code of ethics or morals, they take entirely the stand that ethics is custom made obligatory.

No one of my subjects believes that revenge, that is, the non-transmission of the information, is good ethics or good policy. One said he would have taken revenge, and others said that they would for a long time be tempted to do so. Usually the rejection of the revenge idea is prompt and without conflict.

SERIES III — STORY D

CARD

SLIPS

A young woman is married to a man fifteen years older, with whom she lives very unhappily because of utterly incompatible temperaments. Though they have no children he refuses to consent to divorce. She loves and is loved by a young man who in temperament and person would make an ideal mate for her. The young man begs her to run off with him.

.....

She feels that she must keep her contract and stays with her husband.

She decides there is a higher law and goes with her lover.

Unable to decide, she stays with her husband, but meets her lover secretly.

It will be seen that there is here a conflict between rigid duty as conventionally defined, and personal freedom—the reaching out of the individual for happiness. The ending—she remained with her husband—may be taken as either a triumph for conventional morality (seventh commandment), a triumph for the conception that the stability of the home is the stability of the State, or as the result of a belief that under the present conditions no real happiness would come

to a woman if she eloped with her lover. There is further the viewpoint expressed by Catholics, for example, that marriage is a sacrament, and that no human misfortune or misfortunes should interfere with it. On the other side are those who feel that to go with the lover is more moral than to remain with the husband (the familiar, though very modern, conception that only love sanctifies marriage, and those who believe that the growth of the individual is not to be gained through repression of the sex instinct). There is also the point of view that since the woman has no children she has no duty in the case except to make herself and her lover happy. Some point out that the unhappy home is worse for society than the broken home; and still others (a very few) said that the husband's tyrannical possession is a cruelty and tyranny, against which revolt is socially necessary, and that unless she leaves him a tyrant triumphs, which is bad morals. Whether or not French people would regard the triangled household—that is to say, the compromise situation, where the woman stays with her husband, but meets her lover secretly—as worse than elopement I do not know. At any rate, all of my subjects felt that the lack of personal honor involved in maintaining domestic and sex relations with one man, while the mistress of another, was thoroughly unethical conduct, and to be condemned. However, most admitted that it was very common, and quite human.

What appears with striking emphasis in the series of ethical tests (which embraces a "vow" situation, a life and death situation in which choice rests between chivalry and the good of the greatest number principle, a legal situation—where the choice lies between the "let the law take its course" attitude, and private justice, etc.), is that there is a large group of intelligent people who believe that ethics and morals are merely codes of relative value, and that the private individual has a right to judge for himself. These people have discarded the sin idea, and undoubtedly an investigation carried out in a large mass of people would show that the sin idea is not nearly so common as in previous times. Nevertheless, these same people are very much bound by the conventional code, and it seems evident that inhibitions and judgment thus set up probably control their conduct. Some frankly say that to be in conformity with the group is necessary to them, despite what they may "think," and that therefore they follow, and would follow, the established code.

As I have not as yet tested many people in the ordinary walks of life I cannot say how far the sin principle is involved in judging ethical situations. Amongst Catholics it is very strong, even after so-called liberal education. Whether it is as strong in other religions I am in

no position to state. Most of my subjects take their religion very lightly, many claiming their "own religion"—or "none at all."

As I have stated, the revenge ethics, or revengeful conduct, is largely rejected by these subjects, but in one situation where a man had to choose between helping his wife or pursuing the ruffian who had assaulted her, some men thought it necessary to relegate the care of the wife to others and pursue the assailant. Here was the only situation where revenge appeared as ethically justified to many subjects—that is, the anger evoked by even imagining a situation where a wife was beaten by a ruffian brought about a primitive code of ethics.

SOME THEORETICAL CONSIDERATIONS

The method of multiple choice has for its central point of technic the presentation to a subject of an unfinished story, embodying some situation, and allowing him to choose from a group of completions to the story the ending he prefers. The ending he prefers indicates in part his attitude, judgment or opinion concerning the situation. His tolerance to other points of view, his decision or indecision, his desire to amplify or defend his choice, his externalized introspection are of great importance in estimating his attitude. It is, of course, true that people are not candid, that they may seek to pick out the answer which will please the examiner, but my experience seems to show that a series of tests breaks down this tendency, that especially the impersonal presentation on slips of paper of various choices overcomes these difficulties very successfully.

The interest the tests arouse produces some very clear thinking in persons whom one would not associate with careful consideration of broad, ethical problems. This leads me to extend, in my mind's eye, the field of its usefulness. That is, it seems to me that there are important fields of activity in which tests are used, in which a change in the direction of multiple choice would be of value.

For example, take education. Throughout the school career of the child, and even through college—whether academic or scientific—examinations are conducted on the memory system. A question is asked and the scholar must ransack his memory for facts on which to answer. Emphasis is laid on his ability to recall facts, and the capacity for presentation of these facts constitutes the ability by which he is marked and judged. But this is obviously an over-emphasis of the place of mere memory, and the examination awakens not interest but rather strain. The range of the so-called voluntary associations is tested—the range of the induced associations is not touched. Now these induced associations are the most important in

real life — one depends on face-to-face association, suggestions, criticism and comparison to awaken the stock of facts, ideas and judgments at one's command. What I mean to emphasize is this — that merely asking a scholar a question about a subject is not sufficient to awaken in the majority of persons anywhere near the total or even the most valuable of their associations with that subject.

Therefore, it seems to me that at least in many fields of study the memory system of examinations might well be supplemented by the multiple choice method. The evaluation of an author, an historical event, a scientific theory, ethical teachings and principles — all these would be legitimate fields for its operation. For example, there are varying sets of opinions regarding Tennyson, Dickens, Ibsen; varying sets of evaluations of the results of the French Revolution, likewise different opinions on the influence of Napoleon or Darwin. Themes of heredity can be placed in a few groups, and almost any subject can be presented in a few standardized groups, and the student asked to choose between them (or else to make up his own opinion, and to give his reasons). He would thus be confronted by a segment of real life, he would be asked to choose, to think, to decide, to *act*, in a sense, since his career somewhat depended on his choice. He would be "keyed" up, interest awakened, judgment invoked, and a dozen considerations and emotions not usually touched by the ordinary examination would come into play. The individual as a whole would be tested, mere memory and the grind and crammer would be in less evidence than at present. Perhaps another way of putting the matter is this — the energizing of mentality is partly from within, but largely from without. The memory type of examination depends on the internal, so-called voluntary energizing; the multiple choice system, by providing the student with several opinions to choose from, would act as the external energizer. It would be like placing the student face-to-face with men of different opinions, and asking him to choose, either to accept one set of opinions or to act as judge between them.

Nor is the value of such a method limited, in my opinion, to tests for examination purposes. The teaching method itself should involve choice, if only the constant choice between what is correct and what is incorrect. Commonly made errors in spelling might be placed side by side with the correct spelling, and the children taught to pick out the correct (after first learning the correct). Here there would be a background of error against which the correct would stand out in great contrast. Memory would be called on, but the memory image would be more firmly established because of the necessity of choice. In the same way arithmetical problems could be presented. Tables of

measures could be fixed very firmly in the memory, and I venture to say, much more quickly established by awakening interest and keeping attention alive than by the mere memory system. So would the teaching of declensions, conjugations, and many other matters. It is, of course, understood that the choices to be made would be exceedingly simple in the earlier grades, and become more complicated as the student advanced. What would be gained in interest, in sustained attention, and the growth of critical judgment would be of great value in attaining the goal aimed for — real education.

SPINAL CORD INJURIES IN WARFARE; SYMPTOMATOLOGY AND DIAGNOSIS

A CRITICAL REVIEW

WALTER F. SCHALLER, M.D.

SAN FRANCISCO

INTRODUCTORY REMARKS.....	471
INJURIES (DIRECT AND INDIRECT).....	473
1. <i>Pathology</i>	
2. <i>General Symptomatology</i>	
Muscle Tone and Reflex Action	
Inferior Cervical Syndrome	
Contractures	
Cerebrospinal Hypertension Syndrome	
State of Sensibility	
State of Bladder	
3. <i>Complete Cord Section</i>	
Symptomatology	
Suture of the Divided Cord	
Electrical Reactions	
CAUDA EQUINA INJURIES.....	482
Syndrome of Cauda Equina	
CONCUSSION	483
1. <i>Direct Concussion</i>	
Mechanism and Pathology	
Cervical Concussion Syndrome from Vertebral Dislocation	
Cervical Concussion Syndromes from Injury to Surrounding Soft Parts	
Spinal Hemiplegia with Injury to XI, Cranial Nerve	
2. <i>Indirect Concussion</i>	
Effects of High Explosives	
Mechanism	
State of Cerebrospinal Fluid	
Asthenic Syndrome	
Sphincter Disturbances	
COMPLICATIONS AND OTHER CONDITIONS.....	492
Trophic Lesions	
Camptocormia	
OPERATIVE INDICATIONS AND PROGNOSIS.....	493

INTRODUCTION

The exceptional opportunities which the war has offered for observation of injuries to the nervous system has resulted in a voluminous literature on the subject. It appears that brain and peripheral nerve injuries have been relatively more numerous than cord injuries, yet

no greater advance in organic neurology can be signaled than that resulting from a study of these war injuries to the spinal cord.

In support of this statement, we would mention the revision of Bastian's law as regards cord transection, the automatic bladder and rectal functions of the spinal cord, the automatic cord reflexivity as evidenced by defense reactions, tendon and skin reflexes, the syndromes of cord injuries at different levels, the production of organic injuries by direct and indirect concussion, alterations in the cerebrospinal fluid from the same cause, destructive changes brought about in distal parts of the cord by direct injuries from high powered projectiles, an increased knowledge of the course of sensory fibers as evidenced by numerous cases of Brown-Séquard paralysis and radicular injuries and a better understanding of the cause and nature of so-called trophic lesions complicating spinal injuries. In the scheme of this review the subject matter is arranged under convenient headings and repeated references are made to some of the more important articles.

Attention is called to certain of the larger works dealing wholly or in part with cord injuries. The Books of Roussy¹ and Leri² have been especially reviewed in Nos. 1 and 2, respectively, of this year's ARCHIVES. Cervical syndromes are the subject of a Paris thesis by Rouquet.³ The articles of Holmes⁴ and of Collier⁵ as well as of Head and Riddoch^{6, 7} are noteworthy contributions to the war literature of cord injuries. Such comprehensive works as these are rather subject to outlines than reviews and reference to the originals are necessary for a full grasp of the subjects as presented. Advantage has been taken of a number of excellent references and works reviewing the recent war literature. Among these may be mentioned the War Supplement of the Index Medicus, War Surgery of the Nervous System from the Office of the Surgeon-General, Neuropsychiatry and the War by the War Work Committee of the National Committee for Mental Hygiene, Progressive Medicine, Practical Year Book series (Nervous and Mental Diseases), the Quarterly Cumulative Index of *The Journal of the American Medical Association* and the Medical Supplement to the Daily Review of the Foreign Press General Staff, War Office, London.

In the scheme of this review the organic injuries, including cord concussion, are alone dealt with, the various spinal manifestations of the psychoneurotic states (so-called shell shock) not being considered. Treatment and operative indications are discussed only incidently in relation with the neurologic aspects of symptomatology and diagnosis.

INJURIES (DIRECT AND INDIRECT)

I. PATHOLOGY

Holmes pictures the pathology in a case of transection of the cord. The divided cord ends are swollen, irregular and soft to the touch. Microscopic examination shows severe and extensive changes for at least half a segment above and below the lesion and often further—normal structures not being recognizable. Ruptured disintegrating axis cylinders, and both globules and masses of myelin are seen, the latter being soon absorbed by scavenger cells. Hemorrhages are usually found in the softened areas more marked in the gray matter, but are evidently not an essential feature of the condition. The most striking feature in the sections is the presence of large spherical or irregular cells, obviously compound granule cells originating from neuroglia tissue. A proliferation of connective tissue about the smaller blood vessels also occurs. The secondary changes are degenerative rather than inflammatory and are due to edema and circulatory disturbances, edema being the most important factor. The distal lesions are mostly edema and softening and appear to bear no relationship with the severity of the wound. Hemorrhages are generally present, they are punctiform but frequently larger; but no large central longitudinally spreading hemorrhages as understood by the term *hematomyelia* are found. A striking picture is the swelling of axis cylinders in groups or in isolated fibers. The nerve cells show degenerative changes. Irregular focal patches of simple necrosis may occur as far as four or five segments from the wound, generally in the periphery of the white matter and accompanied by edema. Less complete and irregular lesions of the white matter are more common and practically present in every case. Circular vacuoles, single or in groups, occur, due to swollen axis cylinders. In half the cases, cavities in the dorsal columns, cylindrical or oval in cross section and of considerable size are found in adjoining segments sometimes over four or five segments. The tissues about them are compressed. Although the cavities contain disintegrated myelin and swollen axis cylinders their chief effect must be due to the pressure they produce.

Mussen⁸ studied nine cases of cord specimens by means of Bielschowsky's silver method, Mallory's frozen section method, Marchi, Herxheimer's Scharlach R, and Marchi counterstained by Mallory. Among these cases was one of transverse division, one of *hematomyelia*, *syringomyelia*, *hemisection* of the cord; and concussion and contusion cord injuries. In the case of transverse division a peculiar wave-like condition of an axon is described due to vibratory concussion effect. Excellent plates showing characteristic degenerative

swelling of fibers, proliferation of glia, etc., accompany an excellent descriptive presentation of his subject.

The gross as well and the finer pathology of direct injuries is presented in a clear manner in the work of Roussy and Lhermitte.¹ In this work the pathology of concussion is also dealt with in detail, for the pathology of direct concussion is closely related to, or identical with, the distant lesions of direct injuries. In the main features of these lesions the writers agree that they are primary degenerative and not inflammatory, or secondary to vascular lesions.

II. GENERAL SYMPTOMATOLOGY

Very early in the war, particular attention was given by neurologists to spine and cord injuries because of their special character and complications. Most of the writers made common mention of the poor prognosis and high mortality, and the particularly distressing state of these patients. Paralyzed with loss of sphincter control and often suffering intense pain, they presented a pitiful picture. The transport of these wounded was a matter of serious moment. Schmieden⁹ in the assembly of military surgeons in Strassburg early in 1915 pointed out the danger of complications arising or already existing. He believed that in from eight to ten days a decision should be reached as to whether or not an operation should be done. It was soon evident that Bastian's law, or rather the converse of this law, was not a reliable guide, namely, that a flaccidity and an areflexia of the lower extremities denoted complete cord section. Thus Muskens¹⁰ of Amsterdam in two cases of this kind which were operated on described an intact dura which, however, did not pulsate. Pulsation returned after operative intervention and a certain improvement of symptoms also. Oppenheim¹¹ pointed out that a diagnosis of total section of the cord was not always possible as the accepted signs of this condition were not trustworthy. This writer makes especial mention of pains of great severity in cord lesions—"bladder cramps" of fearful intensity occur. A number of writers report clinical examples of cord injuries in articles dealing with war injuries to the nervous system (Saenger,¹² Babinoff,¹³ Derby¹⁴). In the Bradshaw lecture by Symonds¹⁵ these injuries are considered mainly from the surgical standpoint, an important contention of this writer being the comparatively slight risk of meningitis in septic wounds when treated by the open method.

Important American articles are by Collins and Craig¹⁶ and by Craig.¹⁷ Craig contends that contusion and concussion of the spinal cord may present identical pictures at the onset but may be differentiated usually within twenty-four hours. Concussion is usually charac-

terized by more profound motor than sensory paralysis. Concussion is attended by numbness and tingling in the affected extremities. In the foregoing references most every type of paralysis is represented—paraplegia, hemiplegia, monoplegia, tetraplegia, etc.

Barré¹⁸ early in a careful clinical study of ten cases of cord injuries in which the principal syndromes and types are recapitulated in table form, observes that the clinic picture is practically the same whether the injury is due to bullet wound, shrapnel, bursting of a shell or explosive bomb. Guillian and Barré¹⁹ give some interesting statistics in 225 cases of cord injuries observed by them in the Somme offensive from July 1 to Dec. 1, 1916. One hundred and thirty-eight patients died; 87 were evacuated to the hospitals in the rear. Of the 138 fatal cases the regional distribution was as follows: Cervical lesions, 12 cases; superior dorsal, 43 cases; inferior dorsal, 51 cases; lumbar and sacral, 32 cases. Nine cases of Brown-Séquard paralysis were observed—they all recovered. The cauda lesions showed a tendency towards gradual improvement. Total cord section was relatively rare.

Holmes⁴ has studied clinically 300 cases of gunshot injuries of the spine. He lays considerable stress on the segmental localization of lesions by the determination of motor paralysis and states that this method is as dependable as the usual method of determining the upper border of sensibility disturbances. This is illustrated by a number of clinical cases. Loss of vibratory sensation may also aid materially in location when the dorsal columns alone are damaged. In a study of *muscle tone and reflex* action in cases of severe cord injuries, it was found that the early condition is one of flaccidity of the lower limbs as early as one day after injury. The knee and ankle jerks are lost and remain so for a considerable period (six to ten weeks, period of observation of writer). The abdominal and cremasteric reflexes are more easily abolished than the tendon jerks. In particularly severe injuries no movements of the toes may result either in flexion or extension (Babinski sign) and this condition may persist for weeks. The state of the reflexes and absence of the Babinski sign in severe but not necessarily complete anatomic lesions is explained by spinal shock. In less severe lesions in the early stages, a reflex is described as a "unisegmental reflex" of flexion of the toes, or flexion of the toes associated with contraction of the hamstrings by stimulation of the receptive field of the first sacral segment in the sole. Automatic spinal reflexes of the nature of "mark time" or "steppage" movements are noted only when the lesion involves the upper lumbar segments of the cord. Herpes is found not infrequently at or above the area of sensory loss.

According to the spinal localization certain characteristic symptoms were noted. For example, hyperthermia in the superior cervical cord (at C₄, 104 F.). At D₁ and D₂, marked and persistent increase in the pulse rate. In the middle dorsal region uncontrollable vomiting: Between D₅ and D₈ polyuria, these two latter symptoms being due to disturbed sympathetic nerve function. An *inferior cervical syndrome* is described in detail in lesions of this region of the cord. It is characterized by hypothermia, slow pulse, lowered arterial pressure, scanty urine and a general state of stupor.

According to Collier⁶ an important place must be assigned to intradural hemorrhage which has a tendency to collect at the end of the dural sac causing lesions of the cauda by compression and anemia. The state of the plantar reflex is described as follows by this writer:

There may be four consecutive stages in the condition of the plantar reflexes following a transverse lesion of the cord: 1. An initial extensor response. 2. Either a complete absence of any reflex, which may be the result of shock or of isolation alteration, or a reduced flexion reflex which is the result of isolation alteration which may come on rapidly. 3. The extensor response which when persistent is indicative of a less severe lesion or alternatively of more recovery than the reduced flexion reflex. 4. The normal flexion reflex which returns when recovery is complete. I have repeatedly observed the successive changes from no reflex to the reduced flexion response, and from this to the extensor response in cases in which some improvement is occurring; and conversely I have seen the extensor response change to the reduced flexion response and the subsequent loss of all reflex action in severe cases which were not improving, and in which the only attributable cause for such a change seemed to be the long-standing isolation of the distal segments of the cord. The condition of the plantar reflex is therefore an index of the severity of the damage to the spinal cord and an important early indication as to whether recovery is occurring or not.

Contractures of the feet are discussed by Collier.⁵ There are three principal types: (1) Dropped foot with retracted toes; (2) retracted foot with retracted toes, and (3) dropped foot with dropped toes. This latter type associated with reduced flexor response indicates a more severe lesion than the drop foot with retracted toes associated with the extensor response. The calcaneus position with retracted toes is usually persistent and accompanied by increase of anterior tibial and hamstring jerks and loss of knee and ankle jerks. The extensor toe reflex and withdrawal reflex are present.

A *cerebrospinal hypertension syndrome* is described by Claude and Meuriot.²⁰ It is occasioned by a violent trauma in the posterior cervical region causing contusion and concussion of the cervical cord. The following symptoms occur after a considerable interval:

1. General signs of intracranial pressure including hyperemia of retina or papillo-edema.

2. Local signs of nerve or radicular compression in the cervical region, namely, sympathetic irritation, sensory root disturbances and changes in tendon jerks. Lumbar puncture acts curatively. In civil practice Schachner²¹ reports a case of gunshot injury of the cord at the fourth cervical vertebra successfully operated on. He embodies in this article a review of previously existing notions regarding these gunshot injuries with a good reference to the literature.

State of Sensibility.—Numerous cases of Brown-Séquard paralyses have been reported and special *case studies* made by Roussy,²² Mouzon and Paulian,²³ and Gerstmann.²⁴ In two cases of syringomyelic dissociation of the sensibility diagnosed as central hematomyelia by Souques and Megevand²⁵ the medicolegal aspect of these cases is discussed on the possibility of later cavity formation and production of a syringomyelia of traumatic origin. A case of isolated thermic analgesia in the right lower extremity in a cord injury without any considerable motor impairment led Rothmann²⁶ to believe that the lesion was more or less superficial in the anterolateral column of the cord on the left side at D₁ or D₂. From a study of this case the writer concludes that in cases of obstinate neuralgia in the lower parts of the body section of the anterolateral column might afford relief without fear of accompanying paralytic phenomena.

Holmes⁴ study of the sensibility in his clinic cases led him to the belief that in the middle dorsal region the fibers conducting pain and temperature decussate rapidly and probably entirely within one segment. In the superior dorsal region the decussation occurs within two segments, but in the cervical cord the fibers transmitting pain sensation do not entirely cross for five or six segments above their point of penetration and the fibers transmitting temperature until four or five segments above. Collier⁵ believes that sensibility paths do not cross below the last dorsal segment, therefore a lesion at L₁ or below cannot produce a Brown-Séquard paralysis.

Interesting are the observation and conclusions of this writer on the vexed question of the topography of spinal anesthetics as compared with peripheral anesthetics. He states that in spinal lesions the upper limit of sensory loss is in a line more or less transverse to the axis of the limb commonly designated as "segmental," "glove," or "stocking" type, whereas in lesions of the spinal roots the sensory loss is longitudinal with the axis of the limb, the so-called "radicular" type. In unilateral lesions the bilateral sensory loss in the region of the lesion is narrower for pain and temperature than for touch, and this is even more pronounced in the dorsal than in the cervical region because of the increased obliquity of the crossing fibers. In most cases of unilateral lesion the vibration sense has been most affected

on the side contralateral to the lesion both in severe and slight lesions. There are three principal types of objective pain: (a) Dull and persistent; (b) lancinating, and (c) severe paroxysmal cramps.

State of Bladder.—The state of the bladder and its reflex action is so uniformly associated with the cord lesions that it perhaps should be classed among symptoms rather than complications. Head and Riddoch⁷ studied the action of the bladder in these injuries. In complete cord division the bladder may begin to act automatically as early as twenty-five days afterward. In chronic septicemia, such as from chronic cystitis or pyelitis, bed sores, etc., automatic micturition may never take place, but when, however, it is established fluid injected into the bladder is reflexly expelled when amounts between 100 and 600 c.c. have been introduced. Even in the period of complete retention the bladder wall may contract from stimulus of a catheter and expel urine through it. Retention is due to spasmodic contraction of sphincter mechanisms. In lesions above the lumbar region scratching of the sole, thigh or abdomen may produce a flexor spasm of the extremities accompanied by discharge of urine. Following a lesion of the lower lumbar and sacral roots, the automatic bladder is not thusly influenced reflexly by afferent impulses but the patient may be aware of tension within the bladder. Pressure on the automatic bladder through the abdominal wall serves not only to facilitate evacuation mechanically but also as a reflex stimulus.

In a large number of spinal cases (450) Walker²⁷ describes four bladder states: (1) Retention from paralysis of the detrusor muscle; this leads to (2) retention with overflow; (3) periodic reflex micturition after a certain quantity accumulates—state of the infant's bladder; (4) paralytic incontinence when the bladder is flaccid and the sphincter atonic. This takes place when the lumbar centers are destroyed. Complete retention is the first phase of all spinal lesions in which micturition is affected and occurs also in cauda lesions. Periodic reflex micturition is the second phase. In considering treatment which is well presented in detail the indications are along two chief lines: that of drainage of the urine, and that of treatment of sepsis when established. In the first indication the tied-in catheter has not been successful in the author's experience, causing irritation and inflammation. He is inclined to favor suprapubic cystotomy in the early retention stage before infection as a prophylactic measure but has not yet tried this procedure. In calling attention to the frequency and seriousness of bladder infection in cases of gunshot wounds of the spinal cord due to infection from repeated catheterization, Besley²⁸ strongly advises against catheterization. He makes it his practice to permit the bladder to become distended and overflow

stating that this distention is not harmful to the bladder or kidneys and that there is practically no danger of bladder rupture. He mentions a case of removal of a benign cord tumor in which the bladder was distended to the umbilicus for nearly two years, the patient finally regaining control of the bladder function.

III. COMPLETE CORD SECTION

Symptomatology.—Since Bastian's clinical study of transverse cord softening in 1882, most clinicians have accepted his views. He contended that in anatomic interruption of the cord, the limbs below the lesion were in a state of total flaccid paralysis and areflexia, and sensory loss was complete. This condition remained permanent. In a careful perusal of his writings, however, it is interesting to note that mention is made of the existence of a plantar reflex and a periodic discharge of urine. Although there have been certain observers who have questioned Bastian's law, especially as to the permanent loss of tendon reflexes, it remained for the unparalleled opportunities of the war to establish the facts by numerous and careful observations. The subject is presented by Riddoch⁶ in a critical analysis of eight cases of complete division of the cord. The course which the cases run is described in three stages: (1) Stage of flaccidity; (2) stage of reflex activity, and (3) the stage of gradual failure of reflex functions. The contents of the bladder and rectum may be voided automatically. A widespread reflex action from afferent stimuli, consisting of flexor spasm of lower extremities, abdominal wall, evacuation of bladder and sweating is designated as "mass reflex" in complete section. The flexor muscles in all phases show more tone than do their antagonists. Comparing the manifestations of complete and incomplete lesions, the author states that there are no manifestations by which we can be certain that the spinal cord has been anatomically divided. But certain manifestations were found in incomplete lesions, not occurring in complete lesions; of such, noteworthy were the difference in character of flexor responses as compared with the "mass reflex"; a slower relaxation phase in the knee jerks; no obvious tonus difference in flexor and extensor groups; and especially the presence of extensor responses designated as postural reflexes, dependent on the integrity of certain descending propriospinal paths. Examples are homolateral or bilateral extension of the lower extremities by stimulation of upper receptive fields or by gently pressing on the sole when the limb is passively flexed (extensor thrust). Further, in these cases of incomplete division, muscular action of the ipsilateral limb is diphasic in character (flexor and extensor) as compared with the uniphasic type (flexor) as seen in complete lesions. In certain cases

of incomplete lesions the action is comparable to the steppage movement of the spinal dog. Tonus of all the muscles is constantly below normal in the resting state after total transection.

A typical example of a case observed by the authors over a long period and described in great detail is briefly abstracted:

Directly after being wounded the patient experienced the sensation as if the lower part of his body and legs were missing, consciousness was not lost and his mind was clear. Motion and sensation were completely lost in the lower limbs—there existed a flaccid paralysis with loss of all reflexes. This condition lasted for twenty-two days and then he entered on the second stage. Tendon and cutaneous reflexes began to appear. Urine was voided at regular intervals and the rectum began to functionate. Sweating took place in the lower extremities. Riddoch states that this stage of reflex action may exist for months or indefinitely until intercurrent affections change it or end it. Toxic absorption as from an infected bladder or a decubitus may exist even during the initial shock, and this stage of reflex action may never be entered on. The condition is then similar to that described by Bastian. The muscles are toneless and waste, reflexes of defense are wanting and automatic evacuations of the bladder and rectum may be absent or present to only a slight degree. The authors strongly advise early catheterization, as over-distention of the bladder prolongs the state of retention by diminishing the excitability of the detrusor muscle and may cause cystitis or hemorrhage.

Another important article is by Guillian and Barré.²⁹ These writers report fifteen cases, but their period of observation was a short one; the longest duration of life was forty-one days, and in most of the cases considerably shorter. The tendon reflexes were as a rule abolished, the plantar cutaneous reflexes were generally in flexion and the reflexes of defense were usually absent. Hypotonia was not a constant finding even at the onset. Anesthesia was complete, retention of urine was the rule, but the state of the bowels was more commonly one of incontinence than retention. It was noted that the lower limbs invariably showed an elevation of temperature more marked in the feet. Holmes⁴ is of the opinion that in total transverse lesions of the cord the knee and ankle jerks are probably permanently lost. Preservation of muscle tone is an indication that some improvement may be expected in cases of doubtful lesions. The amount of reflex movement obtained by stimulation of the soles varies more or less inversely with the severity of the injury. Claude and Lhermitte³⁰ report a case with preservation of tendon and skin reflexes; the plantar reflex was first in extension but later changed to flexion. Observations of Dejerine and Long³¹ and Dejerine and Mouzon³² are to the effect that the plantar reflex occurs in these cases always in flexion, and this is interpreted to mean that the pathologic extension reflex of the great toe is not conditioned solely by pyramidal tract degeneration, but an intervention of superior centers is necessary for its production. It appears, how-

ever, from more recent and numerous observations that the position of Holmes and Dejerine et al. is not tenable. Further observation on total cord sections are reported by Gustav Roussy,³³ Claude and Petit,³⁴ and Buzzard.³⁵ The last of these observers reports a return of reflex activity below the lesion, whereas the two former report flaccidity. It will thus be seen that the sum total of these observations does not present a uniform picture.

SUTURE OF THE CORD

After anatomic division of the cord a number of attempts to *suture the cord* have been made. Jacob, Girou and Ferrand³⁶ relate the case of a soldier presenting the syndrome of complete section of the cord in whom operation 130 days after the traumatism revealed a complete division occasioned by a shell fragment at the level of the eleventh and twelfth dorsal vertebrae. After removal of the fragment an attempt to suture the cord and meninges was made, but was only partially successful. Eight days following the operation improvement was noticed, and twelve days after voluntary movements in flexion were noted which increased notably in the period following. The sensibility disturbances receded to a lower level, but retention of urine and incontinences of feces still persisted. In the discussion of the paper, Kirmission, Pozzi and Quenu accepted with reserve the idea of restoration of function by regeneration of fibers or conduction of impulses through the cord. The difficulty of determining complete from incomplete section at the time of operation was emphasized and the improved motor state was attributed to removal of cord compression.

Morat³⁷ in a special article comments on this remarkable communication of Jacob, Girou and Ferrand. He rejects the idea that any regeneration of fibers could take place in such a short time and suggests the possibility of a functional plasticity of the nervous system through the channels of the grand sympathetic to explain the return of cord function. Mayo Robson³⁸ suggests on the basis of previous animal experimentation by himself that one may obtain return of function in a paralyzed cord by excising the injured portion and transplanting in the gap the cord of a recently killed animal such as a rabbit. He reports such an operation in a paraplegic with a certain improvement two months following the operation. A further report of cord suture appears in the publication of Collica.³⁹

In the light of the nature and extent of certain reflex movements such as defense reactions, actual return of voluntary motion may easily be confused with reflex motion. From this point of view it is questionable whether these cases of restoration of function will bear

critical analysis. On the other hand, it may be said that Lhermitte is believed to have demonstrated regeneration of cord fibers. Furthermore, the by-path or connecting path of the sympathetic nervous system may transmit afferent or efferent impulses to or from spinal cord above the division, from lower regions.

Marie and Foix⁴⁰ have studied the *electrical reactions* in cases of total cord section and have noted hypo-excitability to complete loss of reaction in the paralyzed muscles. They have also studied the reactions in incomplete cord lesions. When the electrical reactions are gravely affected the tendon reflexes and defense reactions are lost. The electrical alterations are apt to be most marked in the external popliteal nerve distribution and the absence of the Babinski reflex in these cases is thusly explained in the altered condition of the extensor muscle of the great toe.

CAUDA EQUINA INJURIES

Claude and Porak⁴¹ assert that traumatic injuries of the cauda were extremely rare previous to the war. They have recently observed nineteen cases and report a *syndrome*. Characteristic of this syndrome are early atrophy, trophic lesions, dissociation of the genito-urinary and rectal functions, peculiarities of electric reactions and irregularity of the motor and sensory paralyses. The prognosis is, as a rule, favorable, the majority of the symptoms disappearing without operative intervention. The evolution of symptoms is particularly characteristic in three phases: post-traumatic irritation, paralysis, and recovery. The severe paraplegias commence to walk at the sixth or seventh month.

That there are various syndromes following cauda equina injuries is maintained by Lhermitte.⁴² He describes a superior or lumbar type, a sacro-lumbar type, and a inferior sacral type; further, a syndrome of hemicaudal injuries and polyradicular syndrome. He emphasizes the tendency toward recovery even in severe cases. Guillian et Barré⁴³ also note the relatively favorable prognosis in these injuries in which only seven ended fatally in their series, and these by meningitis. Complete paraplegia is not necessarily of grave prognostic import, and in general prognosis is relatively favorable as compared to cord injuries. There is no inversion of the normal heat regulation as is often seen in cord injuries, but over the affected extremities the temperature of superficial parts is lower than normal. In reporting three cases Mingazzini⁴⁴ lays stress on the sensory and motor dissociation in the extremities and also in the urinary apparatus. There were curious lesions of certain roots without involvement of neighboring roots. In one of the cases the muscular atrophy was extremely rapid; in another case pain was the characteristic feature.

Roussy and Bertrand⁴⁵ report a case of a soldier wounded in the lumbar region and the cauda injured. He was rendered paraplegic, presented atrophy and disturbance of subjective and objective sensibility and a flaccid paralysis. Severe complications in the nature of sacral decubitus and bladder infection were present. There was practical recovery in nine months. In a gunshot wound of the lumbar spine with injury to the cauda, Fearnside⁴⁶ observed destruction of the pelvic autonomic nerves, paralysis of the large intestine and rectum and recurrent attacks of intestinal obstruction, in addition to the usual motory and sensory phenomena. Hassin, Johnstone and Carr,⁴⁷ in civil practice, removed a bullet from the cauda six years after the injury, and obtained marked improvement in the predominant symptom of pain. These authors remark on the relatively infrequent occurrence of these injuries in civil practice and review the existing literature on the subject. Schupper⁴⁸ also reports a case of cauda lesion. Gamper⁴⁹ reports a favorable operative case with rapid recovery.

CONCUSSION

By concussion is meant, not a direct injury to the spinal cord either by a primary wound due to a projectile or a secondary wound such as might be caused by bone fragments or the dislocation of a vertebra or compression, but a condition caused by a sudden mass effect, by a mechanism which is as yet imperfectly understood. The causes and effects are better known. Thus the sudden impact of a high powered projectile striking the spine without injury to the central canal or its membranes may cause profound organic changes in the spinal cord and a grave group of symptoms. This latter example is one of direct concussion according to the convenient classification of French writers (Claude, Roussy and Lhermitte). A second group not so firmly established as the first is designated by them as indirect concussion. In this group belong the cases ascribed to aerial concussion, wind of explosives, and true shell shock, and in which there is no evidence of external wound.

1. DIRECT CONCUSSION

Here again the neurology of the war has greatly advanced our knowledge regarding spinal concussion. Collier⁵ discusses the *mechanism* of spinal lesions by gunshot wounds. The high velocity of a projectile causes a great increase of pressure in the tissues, and if the canal is involved the pressure is transmitted to the cerebrospinal fluid and thereby to the entire nervous system in relation to the canal. In consequence, consciousness is often lost. The projectile is often deflected by the spine, but this does not imply the absence of organic lesions; the shock is transmitted to the elastic intraspinal tissues determining injuries of varying degrees.

The *pathology* of concussion is described by Holmes.⁴ When the cord is not damaged by the fracture or dislocation of a vertebra a more or less uniform swelling may be present opposite the site of impact. Microscopically, the vessels are found engorged, and there are punctiform hemorrhages in the gray matter especially. The most striking change, however, is the edematous swelling of the most affected segments with either diffuse or focal necrosis, and softening. Focal softening also occurs in the gray matter, but are unrelated to the hemorrhages. The distant lesions in cases of concussion are similar to those found in direct and contusion injuries, namely, scattered hemorrhages, irregular foci of necrosis, softening and cavity formation, and extensive parenchymatous changes that often extend over four or five segments in either direction. These consist in the swelling of fibers either isolated or in groups. The disappearance of these fibers leaves vacuoles and cavities in the white matter and gives it a sieve-like appearance. The essential changes may be described as primary disturbances in the vitality of tissue associated with edema and small scattered hemorrhages. Secondary changes may occur due to secondary progressive softening or the development of cylindrical cavities principally in the dorsal columns as is seen in distal lesions of direct injuries. It seems probable that they originate from the accumulation under pressure of transuded fluid and degeneration products from a small primary lesion which tracts upward or downward. Waves of pressure in the cerebrospinal fluid may produce physical defects within the cord and possibly disturbance of its lymph circulation, but the explanation of Fickler appears more probable: by impact on the vertebral column, the cord is made to oscillate within the canal and as its movements will obviously not be synchronous with those of the column it may be directly bruised against the walls of the canal, while at the same time the sudden jarring of the cord produces a physical disturbance in its tissues and especially in the fluid axoplasm of its fibers. Marburg⁵⁰ believes that there is a tearing of lymphatic capillaries resulting in a traumatic edematous degeneration.

Claude and Lhermitte⁵¹ describe the case of a soldier ultimately dying from injuries caused by shell fragments, a state of paraplegia being due to concussion and not to direct injury. A softening from an ischemic lesion was found in the segments D₄, D₅ with secondary degeneration of the fiber columns above and below the lesion. Ependyma changes due to edema and traumatic hydromyelia were also present and the nature of the neuroglia reaction about the ependymal canal suggested the genesis of the lesions in traumatic syringomyelia. A large hematomyelia due to concussion occupying a distance of six dorsal segments is reported by Jumentie.⁵² A bullet traversed the

thorax caused a fracture of the left posterior part of the arch of the third dorsal vertebra, but did not affect the dura or contuse the cord, and did not even produce a hemorrhage into the vertebral canal. Claude and Lhermitte⁵³ describe six types of concussion of the cervical region of the spinal cord. These are: (1) Severe and persisting quadriplegic form; (2) hemiplegic form; (3) form with brachial monoplegia; (4) form of brachial diplegia; (5) cerebello-spastic form, and (6) defaced forms. The histologic examination showed areas of necrosis both in the gray matter and in the white columns. The marginal cord, posterior cornua and subjacent areas were the most affected. Injuries in this region of the cord are of relatively much better prognosis than in other regions of the cord.

Oppenheim^{54, 55} states that when a bullet hits the spine and swerves aside, acute necrosis softening and hemorrhage may occur with intact vertebrae. He has, however, reported several cases in which grave symptoms were only transitory. Bury⁵⁶ also reports cases of concussion. In one case the spine was probably injured and there was an initial loss of consciousness. In the second case the soft tissues were alone involved. The cases showed considerable improvement under observation.

Roussy and Cornil⁵⁷ have observed two cases of spinal *concussion from dislocation of cervical vertebrae* resulting in quadriplegia and the symptom complex of Claude Bernard Horner. A transcript of their summary of these cases is as follows.

In the first case the cord lesion was produced by a luxation of the atlas on the axis with fracture of the odontoid process, an accident formerly considered fatal by lesion of the medulla. In the second case the lesion was due to a dislocation backward of the fourth cervical vertebra. This mechanism is interesting because Malgaigne affirms that backward dislocation of the cervical vertebrae is exceptional. After a period of "spinal coma," lasting one and one-half months in the first case, and four months in the second, the quadriplegia regressed in a crossed manner, motility returning simultaneously in the upper extremity and the contralateral lower extremity. In ten months the recovery in motor function in these cases was practically complete with the exception of a slight left hemiplegia in the first case, and a very slight right brachial monoplegia in the second, associated with a slight paraplegia "fruste" which appeared after fatigue. Further, in the first case a syndrome of Claude Bernard Horner persisted on the left side and in the second a Claude Bernard Horner alternans affecting, according to conditions, sometimes and predominately the right side, sometimes the left. The sensibility disturbances persisted presenting especial characteristics: in the first case there was a hyperesthesia in the innervation of the great occipital nerve, a manifestation of the atlas-axis dislocation which is contrary to the observation of Sicard and Roger, who describe anesthesia in this nerve as a sign of fracture of the atlas. This hyperesthesia was marked in the second case. It affected the radicular distribution of C₂ and great discomfort was felt on local irritation such as by wearing a collar.

Apart from cases of aerial concussion and cases of direct concussion by projectiles coming in contact with the vertebrae, Claude and Lhermitte⁵⁸ recognize a class of concussion injuries due to traumatism of the soft parts at a distance from the spine. They report three such cases and conclude from an analysis of the symptoms that the pathology must be the same in this class as in the other class of concussion cases, namely, focal necrosis, acute primary degeneration of myelin fibers, modifications of the ependyma, and degeneration of the posterior roots. Anatomic proof, however, is wanting. In all the observations from the anatomico-clinic standpoint the cord lesions of concussion whether they be due to direct spinal impact or due to actual lesions at a distance from the spine are identical in nature and differ only in degree according to Claude and Lhermitte.⁵⁹ They present definite characteristics which render it impossible to confuse them with other affections of the cord. The essential lesions are insular foyers of necrosis, acute primary degeneration of myelin, modifications in the ependyma and degeneration of posterior roots. The mechanism of these lesions is complex and is due to ischemia, to the laceration of nervous tissue and the hypertension and transmitted shock of the cerebrospinal fluid.

In injuries to the neck without spinal involvement Marie and Benisty⁶⁰ describe two types of clinical syndromes. First Type: In this type the projectile traverses the neck from side to side, the wounded soldier falling forward without loss of consciousness. At first there is quadriplegia with involuntary passage of urine and feces, receding after several days or several weeks to a hemiplegia and finally to a brachial monoplegia, the paralysis being particularly marked in the hand and fingers. The state of the sphincters runs a variable course. There may be severe eschars. There is severe pain which runs a course parallel to the motor paralysis. Objectively are found definite signs of cord lesions: Brown-Séquard paralysis, frequently the sympathetic syndrome of Claude Bernard Horner, exaggeration of reflexes, Babinski unilateral or bilaterally, ankle clonus, incoordination and often a syringomyelia dissociation of the sensibility opposite to the side paralyzed. Definite signs of cord involvement persist in these cases.

Second Type: Lateral wound in the neck, complete loss of consciousness, lack of sphincter involvement. At first flaccid brachial monoplegia to which is added a later oncoming spastic paresis and incoordination of the lower extremity on the same side and of the opposite upper extremity. At this stage sensibility disturbances of syringomyelic type on the side opposite the lesion, and disturbances of deep sensibility on the same side are present. Exaggerated reflexes,

clonus, sign of Babinski are found in the inferior extremity involved. The cause assigned to this type is probably spinal concussion ("commotion").

Bonola reports five cases of lesions of the cord with marked clinical evidence of sensory and motor paralysis of organic type without direct injury to cord or spine. The author explains the method of production of the lesion as due to a violent elongation of the cord by a sudden "redressment" of the spine. The lesions described are small meningeal hemorrhages, tearing of root fibers, rupture of fascicular fibers, fragmentation of cells, etc.

Conservatism toward operations in concussion cases especially when the spinal lesions are doubtful is the position taken by Finkelburg.⁶² The disseminated character of the lesions which may extend the length of the cord and the possibility of complete recovery without intervention are the reasons for his position. He reports a spinal injury at the fifth and sixth dorsal vertebrae, occasioning a complete flaccid paralysis in a young soldier. An operation performed three weeks after the injury revealed an intact dura with no cord compression sufficient to account for the symptoms. Death occurred from respiratory failure before the operation was completed. On microscopic examination there was no hemorrhage found.

In the *Somme offensive* Guillian and Barre,⁶³ among 200 cases of spinal cord injuries, observed fifteen cases of severe organic paraplegia without evidence of local damage to the dura mater. In almost all of these the vertebral column was injured. The most frequent lesion was hematomyelia either alone or with acute necrosis or softening. All of the fifteen cases ended fatally in from three to five days. There were two principal types: one resembling complete division, and the other of focal spinal lesions. Thomas⁶⁴ in an experience in command of the Harvard Unit and observation elsewhere in neurological centers abroad, speaks of concussion effects and believes that the actual extent of the damage to the cord can only be determined when the immediate effects of the injury, and the concussion have had time to subside. He speaks of the favorable prognostic significance of the Babinski sign. The concussion (direct) most often causes an edematous swelling of the cord, disintegration and softening, and hematomyelia.

A residual Brown-Séquard paralysis is reported by Redlich⁶⁵ in a soldier rendered unconscious and immediately quadriplegic by a bullet passing antero-posteriorly through the neck to the right of the vertebra prominens. The symptoms which developed fifteen days after injury were motor paralysis on the right side complicated by an inferior brachial paralysis and sympathetic cervical paralysis on the same side

and crossed sensory paralysis. These symptoms permitted a localization of the lesion at D₁ and D₂. In a case of a soldier with a bullet wound traversing the upper part of the trunk, but not involving the spine, Mendelsohn⁶⁸ reports practical recovery from a paralysis considered to be organic by treatment with spinal galvanism and faradization of muscles.

Roussy and Lhermitte⁶⁷ describe a group of four cases of *spinal hemiplegia associated with a direct injury to the external branch of the spinal accessory nerve*. The main features of this symptom complex are a tardy hemiplegia following the initial shock (quadriplegia or paraplegia), and an amyotrophy of the sterno-cleido mastoid and trapezius muscles. Vasomotor disturbances on the paralyzes side and implication of the cervical plexus may be present. The sphincters are at first affected but function is regained, and the hemiplegia diminishes in intensity.

II. INDIRECT CONCUSSION

Although anatomic evidence is lacking to support the contention that organic alterations in the spinal cord occur in cases of aerial concussion there are many clinical cases reported which argue in favor of this contention. The *effect of high explosives* on the central nervous system is presented by Mott⁶⁸ in the Lettsomian Lectures. He states that instant death has occurred in groups of men from effects of shell fire when no visible injury has been found to cause it. It has been estimated that the sudden atmospheric depression in such cases corresponds to a dynamic pressure of about 10 tons to the square yard. One effect of this is to liberate nitrogen suspended in the blood and transforms it into bubbles of gas which are driven into the capillary vessels and cause instant death. The writer describes the physiologic effects of shock on the neuron, and the effects of noxious gases. He calls attention to the similarity of symptoms in cases of shell shock with burial and those of CO₂ poisoning. His concluding lecture deals with symptomatology of shell shock which in the majority of cases, notwithstanding a possible organic element, is of predominantly psychic nature. This position taken by Mott appears to represent the views of most neurologists, as can be readily appreciated by even a casual reference to the considerable literature which has grown about this subject.

The *mechanism* of indirect concussion producing, among other nervous phenomena, organic hemiplegias and paraplegias is discussed in detail by Sollier and Chartier.⁶⁹ The physical phenomena of the explosion of a shell is explained. Three different zones surround a man in the vicinity of an exploding shell. In the first zone or zone of violent atmospheric vibration, the individual suffers a blow compared to that from a solid object, and death usually results. In the second

zone there is atmospheric compression caused by the vacuum of the **explosion**. In this zone occurs most frequently hemorrhage of the **cord** and its envelopes. The third zone is one of decreasing vibrations and the resulting states are comparable to those caused from shock by **lightning** and electricity.

Soukhanoff,⁷⁰ a Russian observer, uses the term "air concussion" of the brain and spinal cord, calls attention to the abnormal state of the cerebrospinal fluid in these cases, and explains the psychogenous and hysterical symptoms as complicating secondary manifestations. Roussy and Lhermitte⁶⁷ believe organic changes are more likely to occur in the spinal cord from aerial concussion than in the brain where they are comparatively rare. Roussy and Boisseau⁷¹ believe that in the majority of these cases the symptoms are of the hysteric type and report 133 aerial concussion cases from a total neurological material of 1,300 cases.

In a session⁷² of the Paris Neurological Society on April 6 and 7, 1916, devoted to a consideration of this subject, Clovis Vincent "Rapporteur" classified the nervous manifestations occasioned by shell explosions into three classes: (1) Emotional phenomena; (2) commotional (concussion) phenomena, and (3) mental phenomena. In the commotional state, characteristic were: Clinical objective signs immediately following shock; loss of consciousness; modifications in the cerebrospinal fluid and certain anatomic modifications, such as meningeal hemorrhage, hematomyelia and traumatic encephalitis.

George Guillian, in the discussion, was of the opinion that organic changes were frequently detectable by methodic examinations of the motor and sensory systems and the reflexes. He believed that many organic cases were considered as functional. Souques observed two soldiers in whom three months after the commotion a hyperalbuminosis (0.80 gm.) per liter existed, whereas the lymphocytosis had disappeared a considerable time before. André Leri noted as sequelae, jacksonian epilepsy in one case; and in another the clinical aspect of a myopathic atrophy, plus the Aran Duchenne hand atrophy.

Gustav Roussy in an experience of eighty-one purely neurologic cases following explosions, firmly stood in his position that the symptoms following were of functional nature with rare exceptions admitting, however, that the cases of Ravaut, Pierre Marié et Chatelin, Babinski, Ballet, Heitz and others presented organic lesions. The fact that the majority of cases were cured by psychotherapy and also that rarely were those wounded by explosive shells likewise affected, strengthened this observer in his belief of the psychic nature of the symptoms.

Striking examples of organic injuries following shell explosions are found in the reports of such skilled observers as Babinski and Marie. Babinski⁷³ cites a case of a soldier lying prone in the act of firing and suddenly paralyzed below the waist by the explosion of a shrapnel shell 2 or 3 meters above him. He felt as if his lower extremities had disappeared. There resulted a flaccid paralysis and retention of urine and feces, and he suffered pain in the lumbar region. Twenty-seven days after injury he regained the use of his legs. At the time of observation, nine months after the injury, a Brown-Séquard paralysis was found probably due to hematomyelia in the lower dorsal region from the concussion. Marie and Chatelin⁷⁴ diagnosed a lesion of the lumbar sacral cord in a soldier due to a shell explosion at a distance causing a flaccid paralysis of the right lower extremity. There was no nervous shock, no loss of consciousness and the patient continued to walk several hours after the explosion. They compare these accidents to those observed in caisson disease, following rapid decompression. The explosion of a shell causes a brusque atmospheric decompression, determined by Dr. Arnoux by means of an aneroid barometer in the vicinity of an exploding shell. Gaseous decomposition of the blood with gas emboli and rupture of capillaries follows.

Heitz⁷⁵ from a study of five cases of paraplegia following the bursting of shells at short range without external evidence of injury concludes that the symptoms are organic in nature. The radicular type of anesthetics, sphincter involvement, absence of hysterical manifestations, and course of the cases leads the author to this belief.

Impressed with the severe internal injuries in a fatal case due to shell explosion without external wound reported by Sencert in the *Société de Chirurgie*, Ravaut⁷⁶ investigated the *cerebrospinal fluid* in a case of paraplegia following the explosion of a shell, and found blood in the cerebrospinal fluid. In a later article⁷⁷ he further reported similar cases all of which showed blood or increase of albumin in the cerebrospinal fluid. From these findings he drew the conclusions that the primary symptoms of shell shock are organic and not psychic in nature. Lerich⁷⁸ also finds changes in the cerebrospinal fluid. In cases of concussion with transitory states of torpor and hebetude he has found blood-tinged fluid and a more or less persisting hypertension as high as from 62 to 60 manometer of Claude. This is present in those showing no clinic signs of cerebral concussion. Relief is experienced by lumbar puncture.

A test to differentiate the true concussion cases from the functional shell shock cases is proposed by Weil.⁷⁹ In those suffering from true concussion an excess of glucose is found whereas the cell

count is low and protein contents is generally normal. This is not true in the functional cases.

Mestrezat,⁸⁰ reviewing Weil's paper, states that in his experiences in recent concussion cases an excess of glucose is not always present. In cases of emotion, furthermore, glucose is found in excess quite as frequently as in concussion. He therefore concurs with Weil in his findings in old cases, but believes that too much importance must not be attached to this phenomenon in recent cases.

Guillian⁸¹ describes an *asthenic syndrome due to concussion* without evidence of focal injury. The symptom complex described consists of a profound physical and mental asthenia at the onset with tendency toward betterment and more or less recovery at the end of four or five weeks. At first, the physical weakness is so great that bed-rest is necessary. In the psychic sphere attention memory and idea association are affected. Insomnia, vertigo, trembling of the extremities, involuntary spasms of muscles, myoclonia, exaggerated reflexes and instability and variations in the pulse rate complete the picture.

Pitres and Marchand⁸² maintain that following explosions in the neighborhood there result organic changes in the nervous system. These injuries are the veritable "internal injuries." The cases detailed are those simulating meningitis, general paralysis, cerebellar lesions, multiple sclerosis and tabes. Guillian and Barré⁸³ in a material of several hundred patients suffering from "shell shock" found, in nine cases, retention of urine and, in three, incontinence of urine. These *sphincter disturbances* appeared to be the only symptoms as there were no disturbances of other reflexes and no motor or sensory paralysis. Meningeal hemorrhages were eliminated as a cause, as was also hysteria, the pathogenesis being obscure. The case of retention cleared in from two to six days, but the cases of incontinence persisted longer.

A transient paraplegia, not classified as functional is outlined by Elliot.⁸⁴ At first, there is complete paralysis of the lower limbs, with numbness, hypotonia, and depressed reflexes. The sphincters are rarely involved and the plantar reflex is never in extension. Improvement in sensation and motility returns in about a week and in two weeks or more the patient is able to walk, although complaining of extreme tenderness in the lumbar region and pains shooting up the back.

Leri⁸⁵ relates the following: Due to the explosion of a shell of large caliber at a distance of about 30 feet, a soldier presented motor and sensory symptoms corresponding to S₁ and S₂ radicular distribution. The absence of genito-anovesical symptoms and also of those

dependent on a lesion in the lumbar cord enabled a precise localization in the epicone. Leri and Schaffer⁸⁶ report a case of hematomyelia of the medulla resulting from aerial concussion. Immediately a Millard-Gubler syndrome developed, complicated by a complex cranial nerve and cord involvement. Considerable recovery took place after about a year leaving predominantly a bulbar syndrome which resembled the usual labioglossolaryngeal syndrome differing, however, from this latter by marked sensibility disturbances of the syringomyelic type. Tetraplegia of poliomyelitic type from air concussion is reported by Gatti.⁸⁷ The paralysis was extremely acute. The writer could refer to only one similar case on record, although instances of traumatic poliomyelitis are found in the literature.

COMPLICATIONS AND OTHER CONDITIONS

In commenting on the great danger of eschars menacing the recovery of those suffering from cord injuries, Marie and Roussy⁸⁸ maintain that, contrary to the opinions of Charcot, Vulpian and Brown-Séquard, these lesions are not due primarily to an improper cord function, but their causes may be found in exogenous infections and by pressure long continued. Loss of motility, impaired sensation, altered vascular supply, humidity and uncleanness are contributing factors. They may be considered as *local trophic conditions*. The indications for treatment are immediate and preventative. Opiates should be given when there is incontinence of feces, and when there is an incontinence of urine a permanent catheter should be employed closed at the extremity. In retention of urine a permanent catheter is also advised with the usual methods of fixation and drainage. The position of the patient should be changed hourly during the day and every two hours at night. In case a decubitus has started a drying powder such as a phenol powder may be used. When the bladder is infected irrigations of weak solutions of potassium permanganate or nitrate of silver are advised. Twice daily, after each irrigation, 10 c.c. of *huile goménolée* is introduced into the bladder, the catheter being withdrawn slowly so that the entire urethra may be medicated.

Roussy,⁸⁹ considering the question of complications, believes that prognosis more often depends on complications than on the actual spinal lesion itself. He believes that meningomyelitis is rare because in a large number of necropsies he has not seen an example of diffuse infective myelitis or diffuse meningitis after gunshot wounds. The lesions are rapidly shut off above and below by adhesions. Early operative interference is contraindicated. In the medical and surgical society meeting of the First French Army, April 12, 1916,

Roussy⁹⁰ read a paper on cord injury complications, especially mentioning the pulmonary and pleural complications. He detailed several case reports. In order to combat an ascending meningitis after laminectomy, Klapp⁹¹ advises venous stasis (Bier's method) and repeated lumbar puncture. Believing that the cause of death in the majority of cases of cord injury is due to pyelonephritis Schum⁹² recommends cystostomy, Goldberg⁹³ advises administration of urinary antiseptics from the time of injury and, in retention, regular catheterization.

The Paris thesis by Saloff⁹⁴ has for its theme *camptocormia*. This is a term used by Souques to designate an abnormal functional posture assuming the form of a more or less permanent flexion of the trunk on the hips with extension of the head. It is due to muscular contraction (not contracture) chiefly affecting the abdominal muscles, the lumbar portion of the erector spinae and occasionally the psoas. In the supine position the faulty posture corrects itself spontaneously on a resisting surface. There are no accompanying organic lesions. The condition occurs in predisposed persons frequently under war conditions and is cured by suggestion. The thesis contains histories of eighteen illustrative cases. A series of spinal cases somewhat similar to the foregoing is described and pictured by Redard⁹⁵ in a series of photographs. The attitude resembles that of a man trying to touch the floor with his finger tips. Psychotherapy is a useful aid in addition to physical therapy, but forcible correction is warned against. The organic cases are usually rebellious to treatment. The condition is curable.

Trench spine is classified as neurasthenia by Campbell.⁹⁶ The pain and paralysis are attributed to displacement of the cerebrospinal fluid and a residual disturbance of the lower spinal segments.

Oliver and Winfield⁹⁷ record remarkable low temperatures in a patient presenting a quadriplegia of flaccid type due to a cord injury opposite the sixth cervical spine. By means of a low registering thermometer the rectal temperature, on one occasion, fell as low as 80 F.

OPERATIVE INDICATIONS AND PROGNOSIS

The subject of operative indications depends so largely on a correct neurological diagnosis and on a proper conception of underlying pathologic conditions that some mention would here appear desirable, although it is not properly included in the scope of this review. There have been repeated references, on the one hand, to spontaneous recoveries or marked improvement in severe concussion paralyzes, and on the other hand, to the grave distal lesions in both cases of direct injury and of direct concussion. Further, complete and partial lesions of the cord may present similar clinical pictures.

These considerations have made a number of writers incline to conservatism in regard to operative treatment in doubtful cases, as they hesitate to subject a patient to a laminectomy without reasonable hope of benefit. Guides would appear to be: (1) The nature of the injury; (2) the probable character of the lesion; (3) clinical experiences with the course of these injuries, and (4) especially a thorough neurological examination, for the roentgen-ray examination is not always satisfactory even in cases of frank spinal injury. The general state of the patient and a consideration of existing complications are important. The prognosis of cord injuries is relatively grave both as to life and complete recovery. In an experience at the front, Guillian and Barré⁹⁸ report a mortality of over 80 per cent. in 100 cases of spinal cord injuries. In their experience the lesions are most often due to shell fire. Most patients did not survive three weeks. Pulmonary and urinary infections cannot be held accountable, rather is this high mortality due to one or the other of the following conditions: purulent meningitis; progressive cachexia, or disturbance of the sympathetic nervous system of the digestive tract, abdominal viscera or vascular glands.

Von Eiselberg⁹⁹ in a report to the second German Surgical Congress stated that he had operated in forty cases of gunshot injuries to the cord. In this series there were nine deaths and twenty-four improved cases. In a series of seventy-three nonoperative cases there were thirty-six deaths and thirty-five improved cases. These statistics are in favor of the operative cases, notwithstanding the fact that they were more severe and showed no spontaneous improvement. Except in cases where bone fragments or projectiles can be recognized he has made it a practice not to operate until eight or ten weeks after injury.

In an article reporting thirty-five cases of gunshot wounds of the spinal cord, Ascher and Lichen¹⁰⁰ relied mostly on the neurological diagnosis to guide them in their operative treatment. The neurological findings located the injury somewhat higher than actually found. In twelve cases operation was considered contraindicated. The mortality was 25 per cent. Perthes,¹⁰¹ in a report of six cases in which the projectile remained in the spinal canal, observed marked improvement in two cases following operation. He believed that laminectomy should be performed only in cases of partial cord section, but emphasizes the fact that there may be clinical signs of complete section when anatomically a part of the cord is preserved. In partial section an operation should be performed at once.

A study by Marburg¹⁰² is devoted to a consideration of grave lesions of the cord which manifest little or no tendency toward

recovery. The pathologic condition underlying these states may be different yet present similar clinical pictures. Thusly, contusion, compression, softening or edema may stimulate total cord section. Especially does the author lay stress on the frequency of circumscribed post-traumatic arachnoiditis simulating complete cord section. He reports such a condition in a Russian soldier benefited by an operation to the extent that he was able to walk again with support.

Marburg and Ranzi¹⁰⁸ take the position that operation should be delayed until the spinal lesions are stationary. Pulmonary, abdominal, and renal complications (ascending pyelitis) are operative contraindications.

Spinal shock may simulate complete transverse lesion of the cord and Leva,¹⁰⁴ in a total of nine cases of this character, noted three practical recoveries with the exception of increased reflexes. Roussy and Cornil¹⁰⁵ in an analysis of five cases representing different types of paralysis report marked improvement even in severe quadriplegic forms.

In the Berlin Society of Neurology and Psychiatry (session of Jan. 11, 1915), Borchard¹⁰⁶ reported two cases of apparent total cord section in which, although the dura was intact, the cord was profoundly damaged. Hennenberg demonstrated a cord specimen of similar character with intact dura. The cord was the seat of a considerable degeneration consisting of necrosis, numerous granule cells and neurologia reaction. Rothmann believed that these histologic changes were contraindications against operation and that operation should not be done in every case of spinal paraplegia.

Lewandowsky¹⁰⁷ takes an extremely conservative position in regard to operative intervention. He maintains that operation is nearly always contraindicated, as it is useless in total cord section and partial ones do better without operation. The injuries which improve are those due to traumatic necrosis and hemorrhage and not to laceration. In contrast to the foregoing, some surgeons take a radical view in regard to operative measures. Hull,¹⁰⁸ for instance, believes that harm may be done by delay because of sepsis or compression. In a material of twenty-five operative cases Fragenheim¹⁰⁹ reports six deaths. Fragenheim asserts that contusion of the cord, compression of the cord and complete transverse severance may give the same clinical picture with loss of control of bladder and rectum. It is difficult to demonstrate with the roentgen ray, projectiles or bone fragments compressing the cord, so the author advises exploratory laminectomy in all cases. Goldstein¹¹⁰ reports a case in which the symptoms of complete cord section had existed for a long period. An operation was followed immediately by amelioration of symptoms. He believes that

adhesive traumatic meningitis as well as osseus compression can simulate total section symptoms and inclines to the side of operative treatment even though at times no benefit may result. Armour¹¹¹ believes in surgical interference when there is incomplete section and the patient is in fair condition. He protests against undue operative delay.

Gray¹¹² gives the following indications for operation at a casualty clearing station:

1. In the presence of incomplete paralysis of motion or sensation below the lesion, especially.
2. If the roentgen ray shows displaced fragments of bone or the presence of a piece of metal in or near the cord.
3. When the symptoms of paralysis have developed after the infliction of the injury, unless due to inflammation in patients who have been "lying out" when operation is practically hopeless.
4. When pain, due to pressure on nerve roots, is excessive and uncontrollable.
5. In very exceptionable cases, when the character of the wound is such that sepsis, although not already evident, is likely to develop and cause rapid death. In all other cases it is better, when feasible, that the patient should be evacuated.

BIBLIOGRAPHY

1. Roussy, G., and Lhermitte, J.: *Les blessures de la moelle et de la queue de cheval. Forms cliniques et anatomiques*, Masson et Cie, Paris, 1917.
2. Léri, André: *Commotions et émotions de guerre*, Masson et Cie, Paris, 1918.
3. Rouquet, Joseph-Jean-Guillaume: *De quelques syndromes cliniques dus aux lésions de la moelle cervicale par projectiles de guerre*, Bordeaux, 1916.
4. Holmes, Gordon: *Spinal Cord Injuries of Warfare*. *Goulstonian Lectures*, *Brit. M. J.* **2**:769, 815, 855, 1915.
5. Collier, James: *Gunshot Wounds and Injuries to the Spinal Cord*, *Lancet*, Lond. **1**:711, 1916.
6. Riddoch, G.: *The Reflex Functions of the Completely Divided Spinal Cord in Man, Compared with those Associated with Less Severe Lesions*, *Brain*, Lond. **40**:264, 1917.
7. Head, H., and Riddoch, G.: *The Automatic Bladder, Excessive Sweating and Some other Reflex Condition*, in *Gross Injuries of the Spinal Cord, Brain*, Lond. **40**:188, 1917. *Abs. Prog. Med.* **3**:259, 1918.
8. Mussen, A.: *The Finer Histological Changes in the Traumatic Degenerations of the Spinal Cord Following Bullet Wounds of the Cord Substances or Shock to the Vertebral Column*, *Rev. Neurol. & Psychiat.* **14**:417, 1916.
9. Schmieden: *Verletzungen der Wirbelsäule und des Rückenmarks*, *Deutsch. med. Wchnsch.* **41**:995, 1915.
10. Muskens, L. J. J.: *Operations befund bei anscheinend Kompletter Rückenmarksquerlasion durch Schüsswunden*, *Neurol. Centralbl.* **34**:7, 1915.
11. Oppenheim, H.: *Zur Kriegneurologie*, *Berl. klin. Wchnschr.* **51**:1853, 1914.

12. Saenger, A.: Ueber die durch den Krieg bedingten Folgezustände im Nervensystem, München. med. Wchnschr. **62**:521, 564, 1915.
13. Babinoff, Y. K.: Injuries to the Nervous System Caused by the War, Morsk. vrach, Petrograd, 1915, p. 503-14. Abs. Neuropsychiatry and the War, p. 192.
14. Derby, R.: Gunshot Injuries of the Spinal Cord, Ann. Surg. **61**:686, 1915.
15. Symonds: The Bradshaw Lecture on Laminectomy in Gunshot Injuries of the Spinal Cord, Lancet, Lond. **1**:93, 1917.
16. Collins, J., and Craig, C. B.: Injuries to the Spinal Cord Produced by Modern Warfare, Jour. Nerv. & Ment. Dis. **44**:527, 1916.
17. Craig, C. B.: Injuries to the Spinal Cord Produced by Modern Warfare, New York M. J. **104**:1035, 1916.
18. Barré, J.-A.: Remarques sur quelques cas de blessures de la moelle par projectiles de guerre, Rev. neurol. **28**:567, 1914-1915.
19. Guillian, G., and Barré, J.-A.: Les plaies de la moelle épinière par blessures de guerre, Bull. et mém. Soc. méd. d. hôp. de Paris, **41**: (3 serie) 896, 1917.
20. Claude, H., and Meuriot, H.: Le syndrome de hypertension céphalo-rachidienne consecutif aux contusions de la region cervicale de la column vertébrale, Progrès méd. **31**: (3 serie) 223, 1916.
21. Schachner, A.: Injuries to the Spinal Cord with Report of Gunshot Injury of the Cord at the Fourth Cervical Vertebra and Successful Removal of Projectile, Surg., Gynec. & Obst. **22**:706, 1916.
22. Roussy, G.: Syndrome de Brown-Séquard par balle de fusil dans le renflement cervical (C₆), Rev. neurol. **28**:205, 1914-1915.
23. Mouzon and Paulian: Hémiplegie spinale droite avec syndrome de Brown-Séquard et paralysis radiculaire droite C₄-C₆ par balle de shrapnell ayant pénétré par la racine du nez et logée a la partie droite du corps de la 111^e vertèbre cervicale, Rev. neurol. **28**:411, 1914-1915.
24. Gerstmann, J.: Drei Falle von schwerer Rückenmarkschädigung nach Schussverletzungen der Wirbelsaule. Brown-Séquardschr Symptomen Komplex mit Gunstigem Ausgang, Mitt. d. Gesellsch. f. inn. Med. u. Kinderh. **14**: No. 9, 1915.
25. Souques, A., and Megevand, J.: Prognostic de l'hématomyelie centrale par blessure de guerre à propos de deux cas de dissociation syringomyelique de la sensibilité, Rev. neurol. **29**:280, 1916.
26. Rothmann, M.: Ueber isolerte Thermanalgesie eines Beines nach Schussverletzung des obersten Brustmarks, Neurol. Centralbl. **34**:153, 1915.
27. Walker, J. W. T.: The Bladder in Gunshot and Other Injuries of the Spinal Cord, Lancet, Lond. **1**:173, 1917. Abs. Year Book, p. 136, 1917.
28. Besley, F. A.: A Plea for the Noncatheterization of the Urinary Bladder, J. A. M. A. **69**:638 (Aug. 25) 1917.
29. Guillian, G., and Barré, J.-A.: Etude anatomo-clinique de quinze cas de section totale de la moelle, Ann. d. méd. **4**:178, 1917.
30. Claude, H., and Lhermitte, J.: Les réflexes tendineux et cutanés, les mouvements de défense et d'automatisme dans la section totale de la moelle d'après une observation anatomo-clinique, Ann. d. méd. **3**:407, 1916.
31. Dejerine, J., and Long, E.: Soc. de Neurol. Paris. Seance du 12, Dec., 1912, Rev. neurol. **24**:769, 1912.

32. Dejerine, J., Mouzon, A., and Mouzon, J.: Sur l'état des réflexes des les sections complètes de la moelle épinière, *Rev. neurol.* **28**:155, 1914-1915 *ibid.*, 201.

33. Roussy, G.: Deux cas de section de la moelle par plaie de guerre sans d'autopsie, *Soc. de Neurol. Paris. Séance du 5 Nov. 1914, Rev. neurol.* **28**:36, 1914-1915.

34. Claude, H., and Petit: Trois cas de section complète de la moelle épinière par balle. *Soc. de Neurol. Paris. Séance du 3 Dec. 1914, Rev. Neurol.* **28**:27, 1914-1915.

35. Buzzard, E. F.: Complete Division of the Spinal Cord with Return of Reflex Activity below the Lesion, *Proc. Roy. Soc. Med. London* **10**:40 (*Neurol. section*) 1916-1917.

36. Lorat-Jacob, Girou Emil and Ferrand: Notre sur un cas de retour partiel de la motilité volontaire survenue après suture de la moelle épinière complètement sectionnée par un éclat d'obus (intervention pratiquée 130 jours après le traumatisme), *Bull. de l'Acad. de méd. Paris* **74**:423, 1915.

37. Morat, J. P.: Remarques sur un cas de section complète de la moelle épinière suivie d'une restauration partielle de la sensibilité et des mouvements des régions d'abord paralysées, *Lyon Chir.* **12**:761, 1914-1915.

38. Mayo Robson, A. W.: The Treatment of Paraplegia from Gunshot or other Injuries of the Spinal Cord, *Brit. M. J.* **2**:853, 1917.

39. Collica, I.: Trattamento delle lesioni traumatiche spinalis con reporto di due casi di sutura del midollo, *Riforma med.* **23**:553, 1917.

40. Marie, P., and Foix, Ch.: Lésions des nerfs périphériques et troubles des réactions électriques dans les sections de la moelle, *Rev. neurol.* **29**:313, 1916; *ibid.*, **29**:422, 1916.

41. Claude, H., and Porak, R.: Syndrome de la queue de cheval par projectile de guerre, *Bull. de l'Acad. de méd. Paris* **74**:237, 1915.

42. Lhermitte, J.: Sémiologie des lésions de la queue de cheval par blessure de guerre, *Progrès méd.* **33**:267, 1917.

43. Guillian, G., and Barré, J.-A.: Lésions de la queue de cheval par projectile de guerre, *Bull. et mém. Soc. d. hôp. de Paris* **42**:272, 1918.

44. Mingazzini, Giovanni: Lesions of the Cauda by War Injuries. *Il Policlino (sezione medica)* 24 Annee (2 Semestre) 189, 1917; *Abs. Rev. neurol.* 24 Annee: (2 Semestre) 189, 1917.

45. Roussy, G., and Bertrand: Un cas de syndrome de queue de cheval grave avec volumineux escars en voie de guérison au bout de 8 mois, *Tr. Soc. de Neurol. Paris, Séance du 6 Juin, 1915, Rev. neurol.* **28**:1202, 1914-1915.

46. Fearnside, E. G.: Gunshot Wounds of the Lumbar Spine, etc., *Proc. Roy. Soc. Med. London (Neurol. Section)* **9**:32 1915-1916.

47. Hassin, G. B., Johnstone, K. L., and Carr, A. M.: Bullet Lesion of Cauda Equina, *J. A. M. A.* **66**:1001 (April 1) 1916.

48. Schuppper, F.: Sulle lesioni della cauda equina da proiettili di guerra, *Sperimentale*, **70**:223, 1916.

49. Gamper, E.: Schüssverletzung du Cauda Equina, *Wein. klin. Wchnschr.* **28**:119, 1915.

50. Marburg, O.: Neurologie im Kriege, Jahreskurse f. artz. Fortbild. 6 (May): 1, 1915.

51. Claude, H., Lhermitte, J., and Loyez, Mlle. M.: Etude histologique d'un cas de commotion médullaire par éclat d'obus, *Bull. et mém. Soc. méd. d. hôp. de Paris* **39**:680, 1915.

52. Jumentié, J.: Paralysis complète avec anesthésie totale d'origine traumatique (fracture de la moitié gauche de l'arc postérieur de la 11^e vertèbre dorsale) sans blessure ni compression de la moelle et des méninges: Hématomyélie de la région dorsal supérieure, Soc. de Neurol. Paris. Séance du 3 Juin, 1915, *Rev. neurol.* **28**:579, 1914-1915.
53. Claude, H., and Lhermitte, J.: Formes cliniques de la commotion de la moelle cervicale par projectile de guerre, *Rev. de méd. Paris* **35**:535, 1916.
54. Oppenheim, H.: Zur Kriegsneurologie, *Berl. klin. Wchnschr.* **51**:1853, 1914.
55. Oppenheim, H.: Ueber Kriegerverletzungen des peripheren und zentralen Nervensystems, *Ztschr. f. Arztl. Fortbild.* **12**:97, 1915.
56. Bury, J. S.: Note on the Distant Effects of Rifle Bullets; with Special Reference to the Spinal Cord, *Brit. M. J.* **2**:212, 1916.
57. Roussy, G., and Cornil, L.: Deux cas de commotion spinal directe par luxation vertébrale cervicale. Quadriplegie en voie de guérison: Syndrome de Cl. Bernard Horner, *Rev. neurol.* 3-4 Mars-Avril, 1918, p. 233.
58. Claude, H., and Lhermitte, J.: Troubles médullaires dans les commotions directe, mais à distance de la colonne vertébrale, *Paris méd.* **7**:11, 1917.
59. Claude, H., and Lhermitte, J.: Etude clinique et anatomo-pathologique de la commotion médullaire directe par projectiles de guerre, *Ann. de méd.* **2**:479, 1915.
60. Marie, P., and Benisty, A., Mme.: Syndromes cliniques consécutifs aux lésions indirectes de la moelle cervicale, dans certaines plaies du cou, Soc. de Neurol. Paris. Séance du 2 Dec. 1915, *Rev. neurol.* **28**:1300, 1914-1915.
61. Bonola, Francisco: Syndrome de Commotion Médullaire, *Bulletino delle Scienze Mediche* **4**: Series 9, 1916. Abs. *Rev. Neurol.* 23 Année: (1 Semestre) 644, 1916.
62. Finkelburg, R.: Beitrag zur Klinik und Anatomie der Schussverletzungen des Rückenmarks, *Deutsch. med. Wchnschr.* **40**:2057, 1914.
63. Guillian, G., and Barré, J.-A.: Paraplégies organiques graves sans lésions de la dure mere dans les blessures de rachis par projectiles de guerre, *Bull. et mém. Soc. méd. d. hôp. de Paris*, 3 ser. **42**:244, 1918.
64. Thomas, J. J.: Types of Neurological Cases Seen at a Base Hospital, *J. Nerv. & Ment. Dis.* **44**:495, 1916.
65. Redlich, E.: Brown-Séquard'sche Lahmung mit Lahmung des Hals-sympathicus nach Schussverletzungen, *Neurol. Centralbl.* **34**:147, 1915.
66. Mendelssohn, M.: Deux cas de paraplégie de nature organique, *Arch d'électricité méd.* **24**:212, 1916.
67. Roussy, G., and Lhermitte, J.: La forme hémiplegique de la commotion directe de la moelle cervicale, etc., *Ann. de méd.* **4**:458, 1917.
68. Mott, F. W.: Effects of High Explosives upon the Central Nervous System (Lettsomian lectures), *Lancet, Lond.* **1**:331, 1916. Abs. *Neuropsychiatry and the War*, p. 31.
69. Sollier, P., and Chartier, M.: La commotion par explosifs et ses conséquences sur le système nerveux, *Paris méd.* **5**:406, 1915. Abs. *Neuropsychiatry and the War*, p. 100.
70. Soukhanoff, S. A.: Effects of Air Concussion on the Central Nervous System, *Russky vrach.* **14**:1010, 1915. Abs. *Neuropsychiatry and the War*, p. 203.
71. Roussy, G., and Boisseau, J.: Les accidents nerveux déterminés par la déflagration des explosives, *Paris méd.* **6**:185, 1916.
72. Séance des Soc. de Neurol. Paris, 6-7 April, 1916, *Rev. neurol.* 23 Année: (1 Semestre) 573, 1916.

73. Babinski, J.: Lésion spinale par éclatement d'obus à proximité sans blessure ni contusion (syndrome de Brown-Séquard). Soc. de Neurol. Paris. Séance du 3, Juin, 1915, Rev. neurol. **28**:581, 1914-1915.

74. Marie, P., and Chatelin, Ch.: Un cas d'hématomyélie par éclatement d'obus à distance, Soc. de Neurol. Paris, Séance du 29, Juillet, 1915, Rev. neurol. **28**:777, 1914-1915.

75. Heitz, J.: Cinq cas de paraplégie organique consécutive à des éclatements d'obus sans plaie extérieure, Paris méd. **5**:78, 1915. Abs. Neuropsychiatry and the War, p. 93.

76. Ravaut, P.: Les hemorrhagies internes produites par le choc vibratoire de l'explosif, Presse méd. **23**:114, 1915. Abs. Neuropsychiatry and the War, p. 92.

77. Ravaut, P.: Etude sur quelques manifestations nerveuses déterminées par le "vent de l'explosif," Bull. de l'Acad. de méd. Paris **73**:717, 1915. Abs. Neuropsychiatry and the War, p. 94.

78. Leriche, R.: Des lésions cérébrales et médullaires produites par l'explosion à faible distance des obus de gros calibre, Lyon chir. **12**:343, 1915.

79. Weil, P.: L'hyperglycorachie des commotionnés de guerre, Comp. rend. Soc. de biol. **81**:367, 1918. Abs. Daily Review of the Foreign Press. Med. Suppl. **1**:186, 1918.

80. Mestretzat, W.: Valeur de l'hyperglycosie du liquide céphalo-rachidien des commotionnés de guerre, Comp. rend. Soc. de biol. **81**:505, 1918. Abs. Daily Review of the Foreign Presse. Med. Suppl. **1**:395, 1918.

81. Guillian, G.: Syndrome consécutif à l'éclatement des gros projectiles sans plaie extérieure, Reunion medical de la 6 Armee, 4 Novembre, 1915, Rev. neurol. 23 Année (1 Semestre): 690, 1916.

82. Pitres, A., and Marchand, L.: Quelques observations de syndromes commotionnels, etc., Rev. neurol. 23 Année (2 Semestre): 298, 1916.

83. Guillian, G., and Barré, J.-A.: Les troubles sphinctériens transitoires dans les commotions par eclatement de gros projectiles sans plaie extérieure, Bull. et mém. Soc. méd. d. hôp. de Paris **41**:1114, 1917.

84. Elliot, T. R.: Transient Paraplegia from Shell Explosions, Brit. M. J. **2**:1005, 1914.

85. Leri, A.: Hemorrhagie de l'epicone medullaire par commotion (eclatement d'obus a proximite), Rev. neurol. 23 Année (2 Semestre): 133, 1916.

86. Leri, A., and Schaeffer, H.: Un cas de lésion bulbo-médullaire, etc., Rev. neurol. 24 Année (1 Semestre): 1, 1917.

87. Gatti, L.: Paralysis from Shell Air Shock, Riforma. med. Naples, **34**:102, 1918. Abs. Neuropsychiatry and the War, Suppl. No. 1, p. 57.

88. Marie, P., and Roussy, G.: Sur la possibilité de prévenir la formation des escarres dans les traumatismes de la moelle par blessures de guerre, Bull. de l'Acad. de méd. Paris, Séance du 18 Mai, 1915, Rev. neurol. **28**:320, 1914-1915.

89. Roussy, G.: Les complications des blessures de la moelle épinière, Progrès méd. Paris, p. 73, 1918.

90. Roussy, G.: Les complications chez les blessés de la moelle, Rev. gen. de clin. et de therap. **30**:288, 1916.

91. Klapp, R.: Ueber Rückenmarksschüsse und Behandlung der im Gefolge der Laminektomie auftretenden Meningitis, München. med. Wchnschr. **62**:167, 1915.

92. Schum, H.: Zur Behandlung der Rückenmarksverletzungen im Felde, München. med. Wchnschr. **62**:168, 1915.

93. Goldberg, B.: Zur Behandlung der Harnverhaltung bei Rückenmarksschüssen, München. med. Wchnschr. **62**:455, 1915.
94. Saloff, I.: Camptocormie. Plicature vertebrale, Thesis de Paris, 1916-1917, Nr. 108.
95. Redard, P.: Inability to Straighten the Spine as Effect of War Traumatism, Chir. delgi organi di movimento, Bologna **1**:257, 1917. Abs. Neuropsychiatry and the War, Suppl. No. 1, p. 56.
96. Campbell, A. W.: Remarks on Some Neuroses and Psychosis in War, Med. Jour. of Australia, p. 319, April 15, 1916. Abs. Neuropsychiatry and the War, p. 9.
97. Oliver, M. W. B., and Winfield, F. B.: Shrapnel Wound of the Spine with Exceptionally Low Temperature, Brit. M. J. **1**:247, 1915.
98. Guillian, G., and Barré, J.-A.: Les plaies de la moelle épinière par blessures de guerre, Press méd. Paris **24**:497, 1916.
99. von Eiselberg: Ueber Schüsse insbesonere Spätschirurgie, Beitr. z. klin. Chir. **101**:59, 1916. Abs. War Surgery, p. 296.
100. Ascher and Licen: Ueber Schussverletzungen des Rückenmarks und Deren Operative-Behandlung., Beitr. z. klin. Chir. Kriegschirurgisches, No. **23**: 521, 1917. Abs. War Surgery, p. 299.
101. Perthes, G.: Ueber Laminektomie bei Steckschüssen des Rückenmarks, Beitr. z. klin. Chir. **97**:76, 1915. Abs. War Surgery, p. 291.
102. Marburg, O.: Zur Frage der Rückenmarksschüsse, Neurol. Central. **34**: 184, 1915.
103. Marburg, O., and Ranzi, E.: Ueber Rückenmarksschüsse. Wien klin. Wchnschr. **28**:113, 1915. Abs. War Surgery, p. 290.
104. Leva, J.: Ueber Verletzungen des Rückenmarks im Kriege, München. med. Wchnschr. **62**:925, 1915.
105. Roussy, G., and Cornil, L.: Le pronostic des quadriplegies par commotion de la moelle cervicale, Progrès méd. p. 263, Aug. 3, 1918.
106. Borchard: Zwei Falle von Rückenmarksschussverletzungen, Neurol. Centralbl. **34**:137, 1915.
107. Lewandowsky, M.: Ueber die Kriegsverletzungen des Nervensystems Vereingte ärztliche Gesellschaften im Berlin, Dec. 9, 1914, Neurol. Centralbl. **34**:47, 1915. Abs. Year Book, 1915, p. 116.
108. Hull, S. J.: Treatment of Gunshot Wounds of the Spine, Brit. M. J. **1**:577, 1916.
109. Fragenheim, P.: Schussverletzungen des Rückenmarks und der Wirbelsäule, München. med. Wchnschr. **62**:1473, 1915.
110. Goldstein, K.: Zur Operative Therapie der Schussverletzungen der Wirbelsäule und des Rückenmarks, Neurol. Centralbl. **34**:114, 1915. Abs. Rev. neurol. **28**:319, 1914-1915.
111. Armour, D.: Gunshot Wounds of the Spine; Their Surgical Aspect, Lancet, Lond. **1**:770, 1916.
112. Gray, H. M. W.: Early Treatment of Gunshot Injuries of the Spinal Cord, Brit. M. J. **2**:44, 1917.

Abstracts from Current Literature

A CONTRIBUTION TO THE STUDY OF THE PATHOLOGY OF HUMAN AND EXPERIMENTAL POLIOMYELITIS, BASED ON CASES OCCURRING DURING THE EPIDEMIC OF 1916 IN NEW YORK CITY. HUBERT S. HOWE, A.M., M.D., J. Nerv. & Ment. Dis., 48: Nos. 2 and 3, 1918.

The author records in considerable detail the findings in sixteen cases of human poliomyelitis and in seven monkeys experimentally infected. His histologic methods are varied and his descriptions of the lesions are fairly complete and give a very good account of the types of changes which are to be encountered in acute cases. No new lesions are recorded. The reactive cells are grouped in general into five classes, namely, lymphocytes, polyblasts, amoeboid neuroglia cells, plasma cells and polymorphonuclear leukocytes, and the author remarks on lack of any uniformity in the proportion of these various groups to be found not only in different cases but in different areas of the same case. No clinical data such as the duration of life after the onset of the disease, or the extent of the paralytic involvement, nor the relative severity of the attack are recorded. When one studies poliomyelitis material from patients who have succumbed late in the course of the attack after the more acute symptoms have disappeared or have begun to subside, the polymorphonuclear leukocytes are strikingly few in number and the lymphocytes predominate, and the suggestion has been made that the polymorphonuclear cells are only called out in numbers by the early stages of the disease process and rapidly give way to the lymphocytes. So striking is this tendency that material from patients who die from one to two weeks after the onset of paralysis rarely show the polymorphonuclear infiltration at all.

In discussing the histologic picture of cells undergoing destruction the author notes a marked variation in the mode of disintegration, and while conceding that these may be phases of a common disintegrative process he seems to lean toward the hypothesis that they may represent the effect of different pathologic moments. In this connection we must bear in mind not only the temporal relation as expressed in the term phase of disintegrative process, but also the differences in intensity of the destructive factor. Because of the relative selective affinity of poliomyelitis for the anterior horn cells we must postulate a lower degree of resistance for this group of cells, and it seems only logical that the individual resistance of given cells within this group must also vary. Again, in dealing with a bacterial or living virus disease the probabilities are that the dosage of virus received by different cells even in the same nuclear group will vary within wide limits depending on the ease of access from the transmitting medium—blood or lymph or mesodermal tissue as the case may be. If we grant differences both in individual resistance of cells and in the severity of the invasion as well as in the stage or phase at which it is observed, the hypothecation of different pathologic moments seems unnecessary. A quite parallel condition is often seen in other processes leading to nerve cell destruction. Thus, it is not unusual to encounter in the same brain in paresis examples of chromatolysis, neuronophagia, Nissl's *Schwere-sellerkrankung*, axonal reactions and even cell sclerosis.

One of the author's groups of degenerative alterations in the neurocytes is that of single and multiple vacuolization. In his illustrative photomicrographs vacuoles can be seen in the gray matter quite similar in type to those within the cells, and the whole picture is very suggestive of the artefacts not infrequently seen in embedded specimens. The reviewer has encountered difficulty with this type of vacuole. It occurs frequently in paraffin and less frequently in celloidin material, and has been tentatively explained as a result of the too rapid evaporation of the ether, xylol, or chloroform used in the embedding processes. Vacuoles of this type must be looked on with suspicion unless they can be demonstrated in sections cut on the freezing microtome as well as by the embedding methods.

ORTON, Philadelphia.

**IRRIGATION OF THE SUBARACHNOID SPACE. L. B. ALFORD, M.D.,
J. Nerv. & Ment. Dis. 48:359 (November), 1918.**

In a series of interesting experiments carried out in cats and on human cadaver, Alford showed that it is possible to pass solutions from one extremity of the subarachnoid space to the other, providing suitable technic has been employed.

In the case of animals, solutions were passed from the spinal subarachnoid space out through a cranial trephine opening, in the opposite direction and from a lateral ventricle through the spinal subarachnoid space. In the case of the cadaver, in addition, solutions were passed from the lumbar region of the spine out through a needle inserted into a lateral ventricle.

In animals the solutions came in contact with practically all of the surface of the central nervous system, whatever the procedure. With the cadaver, however, the base and only a limited part of the convexity—that in the neighborhood of the trephine opening—are touched. In ventricular irrigations on the cadaver, whether ascending or descending, only the basal and medullary regions come in contact with the solution.

The following antiseptic solutions were successfully used in the irrigations on animals: formalin (neutral), 0.5-0.25 per cent.; boric acid, 3 per cent.; potassium permanganate, 1:2,500; lysol, 1:300; argyrol, 1 per cent. Potassium iodid, 3 per cent.; hydrogen peroxid, 10 per cent., and perchlorid of mercury 1:10,000 were toxic.

Alford believes that this procedure offers a useful method of investigating the action of drugs in the meningeal spaces and perhaps of studying the physiology of the cerebrospinal fluid.

It is a question, however, whether this procedure can be applied in human therapeutics, no matter how desirable it may seem experimentally. As the author wisely puts it, however, in desperate conditions in which little can be done otherwise, and in which almost any risk is justifiable such as septic, pneumococcus or tuberculous meningitis, this method may be attempted.

WEISENBURG, Philadelphia.

PITUITARY DISTURBANCE IN ITS RELATION TO THE PSYCHOSIS OF ADOLESCENCE. BEVERLEY TUCKER, M.D., J. A. M. A. 71:330, 1918.

Studies of psychoses which are more or less clearly related to hyposecretions and hypersecretions of endocrine glands are, of course, what every one is waiting for anxiously. But it is hoped that more and more the psychiatric analyses in these studies will be painstaking and up to the standard of modern psychiatry, so that it will become possible gradually to compare mental reac-

tion types ascribed to endocrine disturbance with other reaction types in which we have no evidence of such a relationship. Such analyses will by no means be easy, but modern psychiatry is quite far enough to attempt them; at any rate it seems that a psychiatrist should at least show that he appreciates this foremost psychiatric demand. In the present paper no attempt has been made in this direction. While the physical descriptions are very good, the psychiatric portion is quite superficial. On account of the importance of the matter we shall, however, in the following give what there is, leaving out entirely the author's general introduction on the functions of the pituitary, etc., as well as what seems to the reviewer the convincing proof that the endocrine situation is what Tucker claims it to be.

1. Cases with evidence of preadolescent hyperpituitarism with apparent increased hypersecretion during adolescence. He gives two cases.

(a) Woman seen at 26. At 12½ she was hypersensitive, had "night rigors," wondered what people would look like if dead, had "transient hallucinations," loss of affection for her mother and sudden changes from gaiety to solemn intenseness.

(b) Girl seen at 15½. After a spell of homesickness at 14½, baby talk, hysterical seizures, writing up and down on paper instead of across, tantrums, loss of affection for her mother, imaginary telephone conversations, playing imaginary baseball, infatuations for various men and women, persecutory ideas. All these symptoms gradually disappeared and she is normal at 19.

2. Cases with evidence of preadolescent hypersecretion with apparent marked decrease of the secretion during adolescence. He gives one case.

Girl seen at 15. At 14½, after a fever, she had trance states in which she refused food, sighed deeply and would not talk. These lasted for days with sudden clearing up. No delusions or hallucinations and no loss of affection for the family. She recovered in three months after administrations of anterior lobe extract.

3. Cases with evidence of normal preadolescent secretion but adolescent decrease of pituitary secretion. Two cases.

(a) Boy seen at 14. At 13 psychosis began. He would repeat many acts—for example, he would walk up and down the front steps thirteen or fourteen times before going to school, cross and uncross his knees until stopped, etc. He could not concentrate enough to write a postal card, could not dress himself, was excitable, irritable, would make grimaces, suddenly jump up and whirl about. "The thought processes were slow." There were no definite delusions or hallucinations. He gradually returned to normal on whole gland pituitary extract.

(b) Woman seen at 18. Her psychosis began at 16. She became dull at school, showed poor memory, had hallucinations of faces peeping at her, and heard voices. She became indolent, unaffectionate and indifferent, and could not concentrate in writing. She was obstinate and appeared wrapped up in her thoughts. Recovered on whole pituitary gland feeding in three months.

4. Preadolescent decrease of pituitary secretion with evidence of further decrease shown in adolescence. One case.

Boy seen at 15. At 14½ he had an epileptoid convulsion. Later two others. He developed loss of ambition, was inattentive, lazy, obstinate, showed lack of emotion, irritability, *wanderlust* (at one time he was away for many weeks). Recovered in less than a year on whole pituitary gland feeding.

Hoch, Santa Barbara, Calif.

A NEW PLEURIGLANDULAR COMPENSATORY SYNDROME. WALTER TIMME, M.D., *Endocrinology*, July-September, 1918.

Under this title, Timme describes a series of cases which form a distinct clinical entity with a definite symptom complex, the basis of which is a thymus-adrenal-pituitary syndrome with the pituitary gland playing the main rôle in the compensation effected. The syndrome begins in the preadolescent period and passes through its various stages in about two decades.

The leading and outstanding symptom in these cases, is great muscular fatigability, and associated with this, a history of recent or concurrent rapid growth and headaches referred to the frontal region and midway between the temples; low blood pressure, and low sugar content of the blood, are characteristic clinical signs during the whole course of the disorder until the final stage, when the pituitary gland may by its compensatory hyperactivity have effected a clinical cure.

Beginning in early youth, a case presents in its incipency, largely the characteristics of status thymo-lymphaticus, or status hypoplasticus of Bartels. There is the complaint of muscular fatigability, and there is usually present the white line of adrenal insufficiency of Sargent. Enuresis is common, the genital development is retarded and in the male there is scrotal implantation of the penis, or cryptorchism or both, the joints are usually hyperextensible and the ligaments relaxed, the skeleton shows abnormal proportioning, teeth are usually delayed in their appearance, the lateral incisors (especially in girls) and the canines are frequently greatly underdeveloped.

At the age of puberty the second stage is reached, the genitalia are retarded in their development, the pubic and axillary hair are sparse, and in the male the pubic hair has the feminine horizontal distribution. Extremely rapid and abnormal growth in length now begins, 5 or 6 inches a year, and the fatigability increases. This rapid growth is ascribed to the lack of gonadal inhibition of growth. The thymus as seen by the roentgen ray is enlarged. A roentgenogram of the skull at this stage shows an abnormally small sella turcica, or a sella bridged over by the clinoid processes hemming in the pituitary. On the capacity of the pituitary to become hyperplastic, and of the sella turcica to accommodate the enlarging pituitary, depends, according to Timme, the further course of the disorder.

At about the 20th year the third stage is reached and the results of the compensatory hyperaction of the pituitary are seen. Growth has continued until the patient is 6 feet or more, enlargement of the hands and feet are noticed, and as the pituitary enlarges the patient suffers from characteristically localized headache, situated anteriorly and between the temples; he is decidedly vagotonic and a roentgenogram of the sella now shows erosion of the clinoids and deepening of the cavity; the blood sugar and blood pressure begin to rise.

In the final stage, three to ten years later, if complete compensation has taken place, there are acromegalic manifestations grafted on the earlier manifestations of a thymic stage, but the blood sugar and blood pressure are now normal and the headaches have disappeared.

In uncompensated cases the sella remains small and bridged, headaches and muscular fatigability continue, attacks of petit or grand mal supervene, there is mental hebetude, and increase of weight occurs, and the cases merge into a dyspituitary syndrome.

Timme incidentally calls attention to the emotional instability and frequent moral and sexual obliquities of hypopituitarics and their tendency to phobias

and compulsions. In discussing the pathogenesis he remarks that status hypoplasticus, which is the clinical picture dominating the first stage, has been variously attributed to adrenal, gonadal and pituitary hypofunction, the thymus alone being supposedly hyperactive. In these cases all these endocrine anomalies are present *ab initio*, and were not some corrective forthcoming the organism would come to early grief, and many patients do succumb early. The deficient adrenal-chromaffin system is to be credited with the great fatigability, the low blood sugar content, the low blood pressure and the white line. The pituitary gland is the critical factor which by becoming hyperplastic compensates, through its blood pressor and sugar mobilizing principles. Feeding these cases with fairly large doses of pituitary produces highly satisfactory improvement.

In the course of the disorder, other glands may be brought into the syndrome and alter the picture somewhat but have no great determining effect on the course of events, and once recognized in any of the early stages the further general progress of the case can be prognosticated with accuracy.

In connection with the rapid growth in the second stage when the pituitary is still small, the gonads undeveloped and the thymus enlarged, one recalls the experiments of Gudernatsch who by feeding tadpoles with thymus gland noted a great increase in their size without metamorphosis. There appears to be a definite relationship between the size of the thymus gland and the gonads. Henderson and Noel Paton noted in castrated cattle and guinea-pigs that the thymus gland was greatly enlarged; Klose and Vogt noted in thymectomized animals that the testicles and ovaries increased in size and that the growth of the animals was retarded. According to Falta the closure of the epiphyses, and hence definite cessation of growth, is brought about by the interstitial cells of the gonads.

F. DEL. MYERS, New York.

THE PATHOGENESIS OF DEFICIENCY DISEASE. ROBERT MCCARRISON, M.D., D.Sc., F.R.C.P., Brevet Lieut.-Col., I. M. S., Brit. M. J. 177: (Feb. 15) 1919

The want of substances essential for the normal metabolism of the human or animal body suggests the need to examine the effects of their deficiency on the organs responsible for digestion and assimilation and for the regulation of metabolic processes. The influence of deficiency of vitamins on the adrenal glands, on the pituitary gland, on the gonads, on the pancreas, on the liver and on the spleen is practically unknown; while that on the thyroid apparatus has been incompletely studied. The author invites attention to the effects of vitaminic deficiency not only on the central nervous system, but on the endocrinal apparatus.

Polyneuritis avium was produced in a large number of pigeons by a diet of polished rice, and the tissues of the birds were carefully studied post-mortem. He concluded that the absence of certain accessory food factors from the dietary leads not only to functional and degenerative changes in the central nervous system, but to similar changes in every organ and tissue of the body. The morbid state to which their absence gives rise is not a neuritis.

The symptom-complex resulting from the absence of these substances is due (a) to chronic inanition; (b) to derangement of function of the organs of digestion and assimilation; (c) to disordered endocrine function; (d) to malnutrition of the nervous system, and (e) to hyperadrenalinemia.

Certain organs undergo hypertrophy—the adrenals; others atrophy—in order of severity, the thymus, the testicles, the spleen, the ovary, the pancreas, the heart, the liver, the kidneys, the stomach, the thyroid, and the brain. The pituitary gland showed a slight tendency to enlargement in adult male birds only.

The enlargement of the adrenals is a true hypertrophy, associated with a proportionate increase of the glands' adrenalin content. The quantity and quality of the adrenalin is approximately the same as that found in health.

Edema has invariably (100 per cent.) been associated with great hypertrophy of the adrenals; while 85 per cent. of all cases having great hypertrophy of these organs had edema in some form. In such cases the amount of adrenalin, as determined by physiologic methods, has been considerably in excess of that found in cases not presenting this symptom, and greatly in excess of that found in normal adrenals.

Inanition gives rise to a similar state of adrenal hypertrophy, and to a similar state of atrophy of other organs, the brain excepted.

The edema of inanition and of beri-beri is believed to be initiated by the increased intracapillary pressure which results from the increased production of adrenalin, acting in association with malnutrition of the tissues. Failure of the circulation and venous stasis may subsequently contribute to it. Age is an important factor determining its occurrence. This finding is held to account in great measure for the occurrence of "war edema" among prisoners of war in Germany.

Wet beri-beri and dry beri-beri are essentially the same disease; the former differs from the latter in the greater derangement of the adrenal glands.

Gastric, intestinal, biliary and pancreatic insufficiency are important consequences of a dietary too rich in starch and too poor in vitamins and other essential constituents of the food. Some of the obscure metabolic disorders of childhood might be examined from this viewpoint as well as from that of endocrine gland starvation.

A state of acidosis results from the absence of so-called "anti-neuritic vitamins"; this state is due to the imperfect metabolism of carbohydrates and to acid fermentation of starches in the intestinal tract. Clinically it is evidenced by progressive slowing and deepening of the respirations.

Great atrophy of muscular tissues results from deficiency of accessory food factors; it is due in part to the disturbance of carbohydrate metabolism in consequence of disordered endocrine function, in part to the action of the adrenals in supplying blood to the vegetative organs of the body at the expense of the muscles.

Profound atrophy of the reproductive organs is an important consequence of "vitaminic" deficiency. It leads to the cessation of the function of spermatogenesis.

The central nervous system atrophies little; paralytic symptoms, when they occur, are due mainly to impaired functional activity of nerve cells, much more rarely to their degeneration.

Because the thymus, the testicles, the ovaries and the spleen atrophy out of all proportion to other tissues, they possibly provide a reserve of accessory food factors for use on occasions of metabolic stress. This reserve, however, is rapidly exhausted.

The bones are thinned; there is loss of bone marrow; the red cells of the blood are diminished 20 per cent.; there seems to be nuclear starvation of all tissue cells. Even the adrenals, which alone of all the organs of the body undergo enlargement, show on section changes in some of their cells

indicative of nuclear starvation. Accessory food factors are nuclear nourishers. Though deficiency of certain accessory food factors is the essential etiologic agent in the genesis of beri-beri, infectious and parasitic agencies are often important causes determining the onset of symptoms. The deficiency renders the body very liable to be overrun by the rank growth of bacteria.

[Eyckman, Sujuki, Funk, McCollum and Kennedy, and others have reported that continual feeding of birds with polished rice induces polyneuritis, in which there was degeneration of nerve cells; the latter is the specific result of the lack of the water soluble B vitamin.¹ The association of endocrinal and neural lesions is especially important, as Hart, Miller and McCollum² reported that in swine fed on wheat and grain mixtures that ensured nutritive deficiencies "no certain abnormal conditions were noted in the ductless glands," but there were marked changes in the spinal cord. McCollum and Pitz have also emphasized the association with dietary deficiency of the pathologic influence of micro-organisms inhibiting the alimentary tract.³]

ARMSTRONG, Katonah, N. Y.

A STUDY OF TWO EPILEPTOID CASES IN SOLDIERS. G. STANFORD READ, M.D., *J. Abnorm. Psychol.* **13**: pp. 32-41.

A thorough appreciation of mental factors entering into the causation and content of epileptic phenomena is relatively new. It represents an important addition to our knowledge even though we cannot as yet see clearly enough to harmonize the importance of physical and mental factors, both of which exist. The two cases in this paper bring some interesting data concerning the development and the psychology of epileptic phenomena.

CASE 1.—This patient is a man, aged 34. He is said to have a very egotistic outlook on life and to be superficially religious. He was greatly attached to his mother and had an unusually severe father, who thwarted and punished him unmercifully. His revolt against this severity was largely repressed. Twelve years before admission he quarreled with a friend in his own home, when his father, who was sick in another room, entered to separate them. Without realizing it, the patient struck his father in the face so that the latter's nose bled. Two days later the father died. After the father's death he was depressed for months and had returning dreams of seeing his father with a bleeding nose. Ever since the incident he has felt that if he saw his friend who was the cause of it all, he would kill him. A few months after the father's death there was another quarrel with a friend. He suddenly felt a weakness come over him, lost consciousness and was violent. This was his first fit. A few years after that another quarrel with the same result. In the army he was a band man. He was always resentful toward authority and when he felt that the bandmaster did not treat him right, and "on other matters coming to a head" he had three unconscious attacks with violence.

CASE 2.—A man, aged 45. This patient had always been a spoiled child, thwarted. He had violent fits of temper. When 16 he was found in the streets insufficiently clothed. At 19 he wanted to become a minister of the Church of England. Not allowed to do this by his Catholic parents, he felt it was the greatest disappointment of his life. Soon after that he developed a terrible temper. At 20, he was working in a mill. There one man bullied him.

1. McCollum, Simmonds and Pitz: *Jour. Biol. Chem.* **25**:239, 1916.

2. Hart, Miller and McCollum: *Ibid.* **25**:239, 1916.

3. McCollum and Pitz: *Ibid.* **31**:241, 1919.

He only remembers that, after a special torment and after warning his persecutor, six or seven people pulled him off this man. Then he had a fit. After that, he had outbursts of temper with hazy recollection. His father's death was followed by a depression and insomnia lasting twelve months. About twelve years ago he went into partnership, found the partner to be a "bad lot," dissolved partnership, but was accused of embezzlement and sentenced to three months. This he claims was unjust and produced intense resentment against the world. Since then he has peculiar spells in which, according to Read, he tries to get square with the world. He is impelled to take a journey. He then calls at a home and books a bogus order, making the person pay a deposit on account (never more than 3 shillings). On return home his recollection is hazy. He has a feeling that he has done something wrong, but also a feeling of relief. For these things he is often arrested. Read also gives an interesting example of hallucinations which foretell the patient's later actions. The relatives give a history of very bad epileptic heredity.

Hoch, Santa Barbara, Calif.

EPIDEMIC ENCEPHALITIS. S. A. KINNIER WILSON, *Lancet* 2:7 (July 6) 1918.

A subject, as Kinnier Wilson says, very much a *l'ordre du jour* at the present is the occurrence in England of a relatively large number of cases which, according to their main features, fall into the general group of acute encephalitis or polioencephalitis and seem to have epidemic tendencies. All of these cases, as might be expected, do not conform to any one rigid type. The development of ophthalmoplegia in a number of them led to the suggestion that the etiologic factor was to be found in botulism, a postulate which proved somewhat alarming, especially in days when the food question was so acute.

Wilson considers it desirable to accumulate as much clinical and pathologic evidence as possible before indulging in generalizations, particularly when a comparatively rare nervous disease occurs in epidemic form. He feels that there is justification for asserting that such a nervous disease has been prevalent in England whose features are sufficiently indicative of encephalitis. It is characterized, in a large number of instances, by pathologic drowsiness amounting not infrequently to stupor. This predominant characteristic of the disease has not hitherto been noted by neurologists in poliomyelitis, either endemic or epidemic. Yet there is a resemblance which should be mentioned between this disease and certain aberrant forms of epidemic polioencephalitis. The weight of evidence, however, suggests that the epidemic encephalitis is not identical with polioencephalitis.

Out of thirteen cases, Wilson selects seven from his personal experience exemplifying various types of the disease, varying either in severity or in localizing symptomatology. The following types have been recognized in actual cases:

1. The acute and fatal type with mainly mesencephalic localization.
2. Severe and fatal type with meningeal symptoms.
3. Mild recovering type.
4. Ponto-medullary superior and inferior type.
5. Severe type with prominent mental symptoms.
6. Cortical type with lethargy, catatonia and mental symptoms.
7. Paralysis agitans type with localization in the regio subthalamica.

Epidemic encephalitis is an acute nervous disease characterized by both general and localizing symptoms; in minority of cases the latter are not prominent. The sexes are about equally affected and there is no special age incidence, infants, children and adults alike being stricken. The onset is relatively acute, the disease being usually established within a few days, occasionally, however, it begins in a fulminating manner.

General Symptoms: These comprise apathy, lethargy, drowsiness, pathologic sleepiness, stupor, absence of initiative and spontaneity, the latter being particularly prominent. Sometimes the lethargy disappears later during the illness; occasionally it is not a noticeable feature.

A certain degree of restlessness or restless delirium with a reduction of mental activity to the level of automatism is quite common. In some cases there is some acute mania, alternating with profound indifference. Catatonia or *flexibilitas cerea* is a frequent symptom. Illusions and hallucinations, as in any toxic psychosis, have been noted. One case presented a typical *Witzelsucht*. Headache, giddiness and violent vomiting may occur. Apparently epileptiform attacks, properly so-called, are not observed. The temperature is often more or less normal throughout the entire course, or it may rise moderately at the beginning or during the illness. In fatal cases it is sometimes increased progressively but irregularly, after the mode of tuberculous meningitis. In a certain percentage of cases, as in a number reported by Economo and Wilson, meningeal symptoms are present. In these instances there is stiffness of the neck and Kernig's sign, but as a rule, neither of these is well marked and never as prominent as in the typical acute meningitis.

Localizing Symptoms: The commonest of all localizing symptoms is that of the general group of superior poliomyelitis, namely, a peri-aqueductal grouping. Most conspicuous among these symptoms is the paralysis of accommodation and corresponding indistinctness of vision or diplopia, the latter being a frequent early symptom. In addition, a certain degree of ophthalmoplegia externa and interna with ptosis may be found which is symmetrical or asymmetrical, complete or incomplete. The pupils may be contracted or dilated, fixed or normal. It should be borne in mind that the patient may have the appearance of mere drowsiness, due to bilateral ptosis, although there is no paralysis. Inability to sustain ocular movement may be the only defect.

The lower cranial nerves to a variable extent form the next most common type of nuclear invasion. The facies is often expressionless due to the bilateral obliteration of the facial lines. There is a distinct predilection for the affection of motor as opposed to sensory cranial nerve nuclei, which seems to indicate a specificity of action in the postulated virus of the disease.

Rarely the limbs are involved. When this occurs, the indications point to a cortical, subcortical, mesencephalic or pontine invasion of the corticospinal paths and not to a cord invasion. This is shown by the absence of wasting and by the conservation of the tendon reflexes as well as by the occasional occurrence of the extensor plantar response. Sensory symptoms are insignificant or absent.

Investigation of the Spinal Fluid: The cerebrospinal fluid in almost all recorded cases has given consistently negative results. No authenticated organism has been detected and cultures from the fluid have remained uniformly negative. Chemically and microscopically, the fluid shows no departure from normal. Pleocytosis is rare and not limited to the lymphocytic type. Wilson regards it as distinctly curious that the fluid shows, in the average case, so

little that is abnormal, particularly in view of the perivascular cellular infiltration usually found on microscopic examination of the nervous system.

Pathologic: From the findings of Wilson's two fatal cases, there is a close resemblance to the details given by Economo and by Netter. Microscopically, there is little on the cranial surfaces beyond meningeal congestion and perhaps a minor amount of patchy localized meningitis. There may also be limited areas of subpial hemorrhagic effusion and hemorrhagic foci. Microscopically, both gray and white matter is the seat of minute hemorrhagic areas scattered irregularly and occasionally massed in a confluent manner. The pathologic condition is essentially diffuse and variable in distribution, for there seems to be little doubt that the regio subthalamica, the neighborhood of the third ventricle and iter, the mesencephalon in general and the motor cranial nerves of the pons and medulla are most frequently the seat of the lesion. The meninges are always affected to a greater or less extent and particularly the pia mater. There is scattered cellular exudate or vascular congestion with perivascular cellular infiltrate. The cells are by no means only, or even mainly, lymphocytic; polymorphonuclear as well as plasma cells may be found. The portions of the brain already mentioned may likewise show an obvious perivascular cellular infiltration which is especially noticeable along the veins. This is of varying extent and the blood vessel walls themselves are unchanged. Parenchymatous alterations of nerve cells such as degeneration, acute and subacute, and actual neuronophagia just as in poliomyelitis, may be seen here and there. Ameboid glia cells or nuclei are occasionally found around nerve cells in a condition of early change. The white matter is generally unaffected but may show secondary alterations. Minor changes of the above general nature may be found in the spinal cord.

Duration of the Disease: In typical cases the duration is variable. It may end fatally in a few days or it may be prolonged for weeks and months. It is doubtful whether there is a complete restitution in all recovered cases. The pupillary and ocular motor muscles are especially sluggish in their return to normal. Netter has noted in recovered cases that defects of accommodation may persist for a long time. Economo's figures of the ratio of mortality are six cases out of eleven, Netter's seven out of fifteen, and Wilson's two out of thirteen.

Nature of the Disease: Clinical and pathologic evidence points clearly in the direction of an encephalitis amounting usually to a hemorrhagic encephalitis of toxic or toxi-infective origin. In all reported cases the cerebrospinal fluid has been bacteriologically negative. No recognizable organism has been detected in the tissues on microscopic examination. In one case reported by Economo, which ran a rapidly fatal course, an emulsion of the brain and spinal cord was injected subdurally into a *Macacus rhesus* by Von Wiesner. The experiment animal died in forty-six hours, having presented the symptoms of profound stupor at least twenty-four hours previous to death, in addition to which there was a paresis of the right hind limb. On examination of the brain, Von Wiesner discovered an acute hemorrhagic encephalitis and recovered a gram-positive diplostreptococcus which he was able to cultivate. Culture of this injected into apes produced somnolence with muscular weakness, while peritoneal injection into guinea-pigs caused death from internal hemorrhage. It is important to note, however, that a filtrate from the original brain-cord emulsion of the patient through a Berkefeld filter when injected into a Macac monkey produced no symptoms. Von Wiesner further states that from all human cases the material of which he was able to avail himself, he succeeded in growing this organism. In view of the unsatisfactory nature of Von Wiesner's conclusions, the question whether this diplostrepto-

coccus is a specific cause of the disease must be left open. The negative bacteriologic findings in the tissues of Wilson's two fatal cases militate against the acceptance of the somewhat summary statement of Von Wiesner's communication. Wilson himself, however, believes that epidemic encephalitis differs from the common type of sporadic poliоencephalitis in the following details:

1. The lethargic element so strikingly manifest in epidemic encephalitis is largely wanting in ordinary cases of poliоencephalomyelitis.

2. Lethargic encephalitis, that is the epidemic form, occurs in winter and spring; poliomyelitis in epidemic form is essentially a disease of the summer and autumn.

3. Epidemic encephalitis is showing a greater percentage of incidence among adults than has occurred in epidemic poliomyelitis.

4. The significant and minor changes in the spinal fluid are not consistent with what is constantly found in acute cases of ordinary poliomyelitis.

5. Meningeal symptoms are more common in poliomyelitis than in the present epidemic encephalitis.

6. The perivascular cellular infiltration in epidemic encephalitis is less intense than in poliomyelitis.

7. If, as has been suggested by Prof. F. W. Andrewes, the present epidemic is merely one of aberrant poliоencephalomyelitis, it is strange that only aberrant cases seem to be occurring.

8. The hemorrhagic element is proportionately more prominent than in epidemics of poliоencephalomyelitis.

9. So far as Wilson is able to ascertain, no family cases have occurred in the present epidemic, while such are far from infrequent in the ordinary poliomyelitis, epidemic or otherwise.

The evidence now available suggests that the present epidemic is a form of infection akin, no doubt, to the virus of poliomyelitis but not identical with it.

An epidemic of cases apparently analogous to those under consideration occurred in Vienna in 1917 and was the subject of a painstaking description found in the papers of Economo. This author coined the term *Encephalitis Lethargica* for the disease. Netter in Paris, during the spring of 1918, observed a similar epidemic for which he adopted the name *Encephalite Lethargique Epidemique*. Wilson very poignantly points out the inconsistency of the term *Encephalitis Lethargica*, for it is the patient who is lethargic and not the encephalitis. He prefers the term *Epidemic Encephalitis*.

Economo calls attention to the mysterious "Nona," an epidemic which took place in Italy and Hungary in the spring of 1890. A full review of this question was published by Longuet in 1892. The contention was then advanced, apropos of Nona, that the cause of the pathologic sleep frequently noted in that affection was the incidence of the morbid process in the gray matter of the iter and anterior part of the floor of the fourth ventricle. Sleep physiologic and pathologic was thus localized in these important structures. Wilson believes there is more to support this interesting contention than may appear at first sight. Reference may also be made to a valuable paper by Breinl, describing a "mysterious disease" which occurred in Queensland in New South Wales in 1917, and which had an alarming mortality. Wilson concludes that there is unquestionably at present an excellent opportunity for solving the problem concerning the cause of encephalitis and thereby of clearing up much that has been obscure in our knowledge concerning this disease

TILNEY, New York.

DISSOCIATION OF VISUAL PERCEPTIONS DUE TO OCCIPITAL INJURIES WITH ESPECIAL REFERENCE TO APPRECIATION OF MOVEMENT. GEORGE RIDDOCK, M.D., *Brain* 40:15, Part 1, 1917.

Although the fact that there resides in the calcarine cortex a dual function since movement and object vision has been known and appreciated for some time, yet the presentation of the subject by Riddock serves to crystallize our ideas in this matter. The article which is based entirely on injuries consequent on the World War is admirably clear and convincing. Perhaps its preeminent value is represented by the information afforded by this dissociation in the realm of prognosis and in this we have a distinct and valuable contribution to our knowledge of the subject. The paper is based on wounds of all types, rifle, machine-gun and shrapnel bullets, fragments of high explosive and bomb-shell casing complicated, in many cases by in-driven pieces of bone and infection. The inclusion in the report, of one case of loss of stereoscopic vision with retention of the actual ability to see, recognize objects, understand their proper use and memory retention of the object brings vividly to mind cases of somatic disturbance in which all types of sensation are intact and yet in which tactile recognition of the object is impossible. This case seems to indicate the existence of a cortical area, the intrinsic property of which is stereoscopic vision and emphasizes the fact that this quality of vision is not a pure corollary of binocular vision, as has been heretofore believed.

The author, however, draws one artificial distinction, implying a lack of analogy between somatic and visual sensibility on account of the absence of immediate contact in the case of vision between the source of the stimulation and the sensitive receiving apparatus; whereas, in reality the stimulation of the retina by means of the waves of energy set up in the ether by the reflection of waves of light from the object seen brings to bear as direct a stimulation as do friction waves in tactile thermic or pressure sensibilities.

In Chapter 1 the author discusses general, underlying principles and his deductions from the extensive study which he has made of the subject and draws the following conclusions:

1. Movement may be recognized as a special visual perception.
2. Appreciation of movement returns before the object as such is recognized, if recovery of vision is occurring.
3. Recovery of vision for movement begins in the peripheral field.
4. Charts of the fields of appreciation of the fields of movement are valuable in prognosis.
5. The dissociations of visual perceptions are analogous to those found in disturbances of somatic sensibility in cases of cerebral injury.

Vision in large part can be viewed as a highly specialized and modified type of general sensation, subject to the same laws and dissociable into component elements. Our vision is the product of a synthesis between movement and object vision—the former being a more generalized sensation similar to the nondiscriminative type of general somatic sensation, the latter a more highly differentiated and specialized type analogous to the discriminative type of general sensibility. In addition, we are able to further differentiate a synthetic product of vision, namely, the appreciation of form or stereoscopic vision which is similar in character to the synthetic product of general somatic sensibility—stereognosis.

The tests were carried out by means of the rough finger test, verified and amplified by examination with the Hardy perimeter and the Bjerrum screen.

The same results were obtained by using squares or circles 1 cm. or 15 cm. in diameter. At the periphery of the dissociated fields, a blending was observed where movement and object vision pass one into the other very similar to our intermediate regions where nondiscriminative and discriminative tactile sensibility shade into one another.

In Chapter 2, which has the caption "Dissociation Between Appreciation of Movement and Recognition of the Object," are grouped ten cases which fall into three subdivisions.

GROUP 1.—*Showing only perception of movement in the affected field in addition to some perception of light.*—This group represented cases in which there was a complete dissociation over a greater or lesser field in which the appreciation of movement was retained, but with complete loss of object vision. In this group there was also included a case which demonstrated the return of movement vision to a considerable extent, with but little improvement of object vision, showing that the dissociation may be the immediate result of the injury or that it may be the late result of efforts toward reparation on the part of the cortex. The recovery of movement vision seems often to begin in the periphery occasionally as isolated area which may or may not later become linked up with the vision area retained at the time of the injury.

GROUP 2.—*Showing recovery of both perceptions though in different degree.*—In this group there are four cases presented:

1. Dissociation and partial recovery of vision for object and movement stimuli in complete homonymous hemianopsia.
2. The same phenomena in altitudinal hemianopsia.
3. The same phenomena in concentric contraction of the fields.
4. The same phenomena in quadrantic hemianopsia.

The first case presented a recovery of vision for movement which antedated the recovery of vision for objects and the extent of improvement of the former at all times during the diminution of the visual disturbance exceeded the latter. The eventual outcome was a paracentral scotoma which through improvement at the periphery suffered a progressive concentric reduction. This residual scotoma reached the point of fixation at one point in the lower part of the field.

The second case presented complete initial blindness which gradually contracted until the final residuum consisted of a central scotoma in the peripheral portion of which there was appreciation of movement, but in its central portion it was absolute for both movement and object vision.

The third case represented the gradual extension of visual fields which were at first limited to the macular region, object vision occupying the very center of this region and movement vision the outlying fringe. A gradual reduction of the area of vision and other manifestations indicated a secondary operation, after which the improvement of vision proceeded gradually and symmetrically, the field for movement vision always anticipating the field for object vision.

The fourth case presented a quadrantic defect similar in dissociation to the preceding in which the field for movement was always greater than the field for objects and in which the same relative concentric reduction took place.

GROUP 3.—*Where no dissociation or recovery of vision occurs.*—According to Riddock's work, it was infrequent to find cases evidencing no tendency toward recovery and although he has no pathologic evidence on which to base his conclusions, he postulates, in these cases, a lesion subcortical in location.

In summarizing these cases, the author emphasizes these points:

1. In recovery in cases of restricted visual fields, the first sign of returning vision is a beginning appreciation of movement.
2. This return always begins at the periphery of the visual field.
3. Whenever improvement takes place, there is always present a dissociation between the perceptions of movement and object vision, the field for the former always being the larger field.
4. This dissociation and its extent are valuable in prognosis.
5. The size of the field is the same, whether tested with white or black objects and whether tested with a 1 cm. or 15 cm. object.

Chapter 3, on *visual orientation and stereoscopic recognition*, is devoted to the consideration of the properties of stereoscopic vision and the evidence that it does not entirely depend on the integrity of binocular vision, but that, in addition, there is a cortical area similar to the stereognostic area in somesthetic sensibility in which resides the faculty of appreciating visual form and depth. The following defects can be summarized:

1. Inability to localize objects—only extremes being appreciated.
2. Inability to compare distances.
3. Inability to appreciate depth and thickness.

These defects were associated with defective tactile localization on the first three fingers, a loss of deep tendon and joint sense, and an interference with the appreciation of the thickness of an object.

Chapter 4 is composed of a careful consideration of the *location of the wounds* and *the defects* as seen on the operating table.

The author from the study of this material has reached the following conclusions:

1. The macular vision-center is situated in the polar portion of each occipital lobe. The retention of macular vision, that is, a failure of the hemianopic line to pass through the line of visual fixation is dependent on sparing of the occipital pole by the morbid process, indicating that the cortical representation of macular vision resides in the occipital pole and is not bilaterally situated for each eye.
2. The superior quadrants of the retina are represented in the upper part of the visual area and the lower quadrants in the lower part of the visual area.
3. The periphery of the retina receives stimuli which then travel to the anterior part of the area striata.

RILEY, New York.

THE MENTAL FACTOR IN THE NEUROSES OF WAR. R. G. GORDON, M.D., Seale Hayne Neurological Studies, 1: No. 2.

The article is characterized by a considerable use of psychoanalytic concepts presented in a form in which neither the analytic color is vivid nor the notions clearly defined. Gordon's first point involves, under the demands of "common sense," the relations of patient and physician, to which he imputes, when properly arranged, much of a therapeutic advantage. Particularly in the hysterics the results are readily gained "through persuasion" based on an effective relationship of this order. It seems to emphasize a conclusion that his modes of "persuasion and suggestion" in the treatment of the hysterics depend largely on what is little else than that, termed in current phrase, "transference."

For two other groups, designated by him as neurasthenia and psychasthenia, he employs what is called "mental orthopedics." Neurasthenia is defined as "extreme fatigability with various physical symptoms due to exhaustion and not dependent on any organic abnormality." Psychasthenia, as compared to this, is a condition in which the adaptation to reality is effected. How far both of these definitions reveal an inadequacy is expanded in his notions of mental orthopedics.

This appears to rest on a preliminary analysis to discover in what direction the patient has gone astray and in what manner the mental processes may be rearranged and properly deflected into healthy channels. He frankly states the source of these notions as freudian, but with many protests of nonorthodoxy. He chooses, for instance, to pursue MacDougal to the thoroughly freudian notion of the direction of complexes by instincts and in complexes notes the chief director of conscious effort. His concept of the unconscious differs only in name, while his notion of conflict appears totally familiar. It is on this latter that the general structure of the symptom is based, in the treatment of which he brings out the old energetic concept of a liberation of energy by a solution of the conflict brought about through the physician. It appears as though many of these conflicts are in considerable part conscious, while the unconscious conflicts are usually of a kind where the "merest scratch is sufficient to lay bare" the unconscious material. Following a solution of what to the patient have been insoluble situations, his work in reeducation is rapidly attained.

There is a prime significance in the handling of the conflicts by persuasion, a mode, as we have seen, resting on the notions of transference. That a deep or considerable unconscious conflict is thus entirely mended is not believable; but that a restitution appears possible and, in the conversion hysteria, a disappearance of symptoms may lend a possible application to the neuroses of peace. It is apparent, however, that under these circumstances we possess no such precipitator of a conflict as war. Hence, it is not unlikely that the material presenting before us may possess no such possibilities of instant revision. It is less possible to reveal it "by a scratch." A second reflection on the article concerns itself with the apt manner in which the concepts of psychoanalysis have come to illuminate the neuroses of war and in their turn, perhaps, to be qualified and extended.

PARKER, New York.

Society Transactions

NEW YORK NEUROLOGICAL SOCIETY

Three Hundred and Sixty-ninth Regular Meeting, Jan. 7, 1919

FREDERICK TILNEY, M.D., *President*

CASE OF AREFLEXIA, ASTERIOGNOSIS AND OTHER SENSORY DEFECTS OF ABIOTROPHIC ORIGIN. Presented by DR. J. L. JOUGHIN.

The patient was a woman, aged 26, unmarried and by occupation a stenographer. The family history was negative. At the Post-Graduate Hospital in May, 1916, she complained of "lack of feeling" in her hands and inability to recognize objects held in them. This condition had existed as long as she could remember. At the age of 17 she had anemia, but no blood test was made. Menstruation had always been normal. She had always exhibited marked fumbling and clumsiness in handling objects and had no ability to recognize small objects and very little ability to recognize large objects by palpation. Slight, jerky movements of her hands, especially of her fingers had always been noticed, but there was no history of actual tremor or ataxia. Sense of position was impaired. For many years there had been excessive sweating of the entire body, especially of the extremities, which were always cold. There was no speech disturbance except a slight lisp which had existed for years. Summarizing and giving only the positive findings there were present: (1) complete areflexia, superficial and deep; (2) a definite, though slight loss of tactile sensibility to light pressure; (3) a more marked loss of muscle sensibility (postural sensibility); (4) a still more marked loss of vibratory sensibility; (5) an extreme enlargement of the circles of Weber. This loss of sense of tactile discrimination (Head) was the most marked sensory defect and the astereognosis was probably due mainly to this. (6) Astereognosis.

The areflexia could be explained by a degeneration (probably partial) of the posterior columns, thus breaking the reflex arc, the mechanism being the same as in locomotor ataxia and Friedreich's disease.

Sensibility was affected principally in its deep modalities and these impulses in all probability passed up the posterior columns to the medulla and so up, via the fillet. The only form of cutaneous sensibility markedly affected was that of tactile discrimination and according to Head these impulses are conducted upward in the posterior columns accompanying the fibers which mediate deep sensibility.

The partial loss of cutaneous sensibility to light pressure (ordinary so-called tactile sensibility) was a little difficult to explain. Many neurologists thought these impulses were conveyed by the posterior columns or by short association fibers in the antero-lateral columns, or by the spino-thalamic tract or by several of these tracts functioning together and substituting for one another. In conditions where the posterior columns were affected—as in locomotor ataxia—cutaneous sensibility to light pressure was often deficient. Consequently, in this patient, while the reason for this loss might be difficult to explain, there was no reason why one should reject the view that there was degeneration of the posterior tracts of developmental or abiotrophic origin.

NEUROLOGIC COMPLICATIONS OF INFLUENZA. Presented by DR. I. ABRAHAMSON.

The speaker said the epidemic disease called influenza was still an unknown quantity so far as its essential cause was concerned. But it gave rise to polymorphic syndromes involving the nervous system. These syndromes might appear early or late; they might complicate or even mask the pulmonary aspect of the disease; they might appear so wholly detached from all pulmonary signs that the unwary would miss their etiologic relationship with the epidemic disease. They could not readily be classified. Neuralgias occurred affecting in all degrees of intensity any sensory area of the body. From the fifth cranial nerve, unilaterally or bilaterally, in one or more divisions, to the second sacral nerve, any nerve might be affected; but the nerves of the face and legs were most commonly implicated. These neuralgias were really true neuritides. Indeed, not only did tenderness and pain indicate the neuritic nature of the affection, but all grades of herpes zoster might give visible proof of inflammation.

Motor palsies at all sites and of all degrees might occur; palsy of the arm and hand muscles, of the thigh, leg and foot muscles, unilateral and bilateral, isolated, and general, severe and mild, transient and persistent. One case of multiple neuritis had been observed in which a lasting bilateral facial palsy was present. Such palsies might arise not merely from inflammation of the peripheral nerves but also from implication of the motor nerve nuclei, especially of the pons and bulb. In only two cases (cervical region) had there been nuclear involvement of the cord. All degrees of meningeal implication might be indicated clinically. Typical cases of encephalitis also occurred.

Among such heterogeneous manifestations it was difficult to distinguish, far less to classify. One might logically assume that during an epidemic nerve affections occurring in unusual frequency were probably of the same origin as the epidemic. One, therefore, looked with suspicion on the "lethargic encephalitis," described by Netter, Claude, and Sainton, a clinical picture suddenly revealed in these epidemic days and identified by these observers as a distinct disease entity. One might equally distinguish "acute ophthalmoplegia," "acute epidemic meningitis," or other acute syndromes. Until the contrary was proven all these bizarre and unusual appearances should be regarded as special manifestations or types of the prevailing so-called "Spanish influenza" and not as separate affections. Dr. Abrahamson had even now one case which, except for the absence of the cherry red spot in the macula, presented all the signs of amaurotic idiocy of acute origin; and another of thrombosis of the superior nasal branch of the central vein of the left eye, along with possible thrombosis of the brain sinuses.

Common to all these cases was their occurrence in epidemic areas. Examination showed that almost invariably there was complete absence of the usual signs in the cerebrospinal fluid, characterizing what was formerly regarded as influenzal (Pfeiffer bacillary influenza) implications of the central nervous system. On the contrary, in the prevailing epidemic, the cerebrospinal fluid was increased in amount, and the mononuclear cells were increased perhaps even as high as 100. The fluid so far as at present determined was sterile. In one case the fluid reduced Fehling's solution; in another there was no reduction. The amount and character of the fluid and the number of the cells varied somewhat according as the meninges or nerve cells of the nervous system bore the brunt of the attack.

DISCUSSION

DR. M. ALLEN STARR expressed his interest in these cases of marked neurologic symptoms following influenza. They certainly showed that there was no part of the nervous system or its coverings which was exempt from attack by the agent responsible for the epidemic. He remembered very well twenty-five or thirty years ago at the time of the first great epidemic of influenza in this country that a number of articles were written on the nervous complications. He recalled particularly that Dr. James J. Putnam came from Boston to read before the Neurological Society a very interesting paper regarding neurological conditions developing subsequent to the grippe, and Dr. Starr distinctly recollected cases described as secondary meningitis and those corresponding to anterior poliomyelitis and superior encephalitis, multiple neuritis and single type neuritis. He therefore considered that there was reason to believe the cases reported by Dr. Abrahamson were postinfluenza cases, and that it was wise to have called attention to the frequency with which nervous complications followed the grippe.

DR. WILLIAM M. LESZYNSKY had seen a few cases of the kind mentioned and also a number of patients in whom mental symptoms developed after subsidence of active infection. In one case the patient had been getting along very well after influenza and pneumonia and the temperature had been normal for one week when it suddenly shot up and the patient became maniacal. She continued in this state for two or three days, the end of the third day, however, finding her sleeping well, taking food and rational. She was in such good condition that ultimate recovery was hoped for, but she died suddenly during the night. Another similar case had ended fatally. Dr. Leszynsky said he had seen a number of psychoneuroses following the grippe and it was a question whether these were a result of the disease alone or whether the influenza was only the exciting cause in a predisposed patient. At the Manhattan State Hospital they had recently admitted about fifty patients with a history of influenza preceding the psychosis, nearly all being of the manic depressive type. There was nothing distinctive in the symptomatology which would lead one to make the diagnosis of a postinfluenzal type without the previous history. From the viewpoint of the speaker, there was nothing in the character of the neurologic manifestations to make one consider them different from those seen in the epidemic of some years ago.

MAJOR GEORGE H. KIRBY, chief of the neuropsychiatric service, U. S. Army Hospital No. 1, said that his experience had been chiefly with soldiers presenting either psychotic or functional nervous symptoms subsequent to influenza, alone or complicated by pneumonia. The clinical pictures met had covered an extremely wide range and had furnished no positive evidence that influenza produced a special or characteristic form of mental disturbance. From the psychiatric standpoint the most common reaction to influenza was a postinfection, or postfebrile, state of neurotic fatigue, vasomotor instability, feeling of mental inadequacy, and depression. Probably these symptoms, in some degree at least, followed practically every case of influenza, but in a majority of cases they disappeared promptly, being regarded as hardly anything more than a manifestation of a general debility, although they were very often indeed out of all proportion to the brief duration of the influenza and were unaccompanied by any marked general physical reduction. In other cases the fatigue and inadequacy symptoms persisted over a long period. Major Kirby felt that very little was known about the clinical position of these

states relative to fatigue syndromes due to other causes or to the so-called psychoneurotic types of neurasthenia.

The deliria (infective-exhaustive psychoses) formed the second most common type of mental disturbance complicating influenza. Particularly frequent during the period when the sensorium was clouded or just after the patient emerged from the delirium, were stuporous and various catatonic-like manifestations which unfortunately were often mistaken for dementia precox. Among the constitutional psychoses, manic-depressive insanity, particularly the depressed phase, most frequently appeared during or soon after influenza. Dementia precox rarely developed in connection with influenza unless schizophrenic traits had been previously in evidence. A few cases of paresis had been observed in which it seemed probable that influenza was responsible for initiating the first psychotic manifestations of the disease. In this connection Dr. Abrahamson's observations on the spinal fluid were suggestive. Major Kirby stated that in none of his cases in which syphilis of the nervous system could be ruled out was there any increase of the cellular content of the spinal fluid. He did not doubt, however, that a nonsyphilitic meningeal reaction might occur as a complication in some cases of influenza. He hoped that reports on the pathologic findings of the central nervous system of cases such as Dr. Abrahamson had observed would soon be made available.

DR. WALTER TIMME said that he had seen few meningitic forms of post-influenzal infection, but he had seen cases of bilateral facial involvement which he believed to be rather rare. The number of cases of these postinfluenza conditions was noteworthy. In Plattsburg there were three men who had had influenza abroad and had recovered. After reaching camp they became similarly affected, first one side of the face becoming involved and then the other side within a week. Another case which seemed to be due to influenza was that of a girl of 9 or 10 years of age in whom the symptomatology was that of poliomyelitis except that instead of depressed reflexes there were exaggerated reflexes, due to cortical cell involvement; polioencephalitis of the Strümpell-Lichtheim type. The cell count was 60 or 70 and there were also mononuclears. It seemed to Dr. Timme that these postinfluenza cases were so widely divergent that they should be considered as complications of influenza rather than as specific syndromes.

DR. H. CLIMENKO had observed, probably synchronously with many others, that the epidemic had transferred potential neurologic and psychologic tendencies into dynamic conditions. For example, a man was said to be suffering from a psychosis following influenza, but Dr. Climenko found the case to be an outspoken one of general paresis. The wife, also suffering from influenza, admitted a number of miscarriages and said that her husband had been treated for syphilis. He had been attending actively to business before the attack of influenza and developed all the acute symptoms of general paresis within a few days. The speaker also had noted that the severity of the influenza was not always in proportion to the severity of the subsequent neurologic symptoms. One patient gave a history of having been sick only one day, but his pupils reacted only slightly to light and one could readily see the possibility of multiple lesions of the brain. Both fluid and blood were negative.

DR. FREDERICK TILNEY described two cases. One suddenly developed paralysis agitans, first manifested in the right hand, then extending to the right leg and now showing a typical Parkinson syndrome. The other patient—a mild paretic—had suffered from influenza for a week when the temperature came down; but that night he jumped out of a window. This was unmis-

takably a fulminating case under the stimulus of added infection. It was very evident that latent processes might be brought out by influenza.

DR. ABRAHAMSON, in closing, said that subsequent to the epidemic of 1889 the discovery of Pfeiffer's bacillus had occurred and since then these micro-organisms had been found in all true cases of influenza. To call these other cases influenzal without bacillary evidence was to deny the value of the finding of the bacillus. No mention had been made in this paper of mental or functional disturbances or involvement of the ductless glands, but there was no doubt that there had been a whole series of these conditions following influenza, particularly involvement of the vasomotor system. Dr. Abrahamson had refrained from labeling his cases influenzal because up to date he had not been able to prove they were such.

THE MECHANISM OF PAIN FROM THE PHYSIOLOGICAL STANDPOINT. Presented by DR. JOSEPH BYRNE.

Dr. Byrne outlined an entirely new theory based on clinico-pathologic studies embracing lesions of the nervous system at various levels from the periphery to the cerebral cortex. Pain had been aptly described by Sherrington as the psychic equivalent of the nociceptive reflex. The speaker regarded the afferent nociceptive arcs as the forerunners of the pain paths leading to the optic thalamus from which indeed these latter were to be considered as developed. All forms of sensibility might ultimately be reduced to two primary forms, namely, (1) affective, and (2) critical. Affective sensibility was that through which one became aware of pain, pleasure or change of state. Critical sensibility, on the other hand, implied comparison. The impulses mediating the fundamental gross affective element (pain or hurt) entered into consciousness mainly in the optic thalamus, whereas the impulses mediating the critical sensibility entered into consciousness mainly at a higher level, presumably in the cerebral cortex. The speaker rejected Head's division of sensibility in the peripheral system of nerves into epicritic, protopathic and deep, and offered his own classification as follows: (1) superficial critical sensibility; (2) superficial affective; (3) deep critical, and (4) deep affective. This classification was simpler than Head's or Sherrington's (extero-ceptive, proprioceptive, and enteroceptive) and more in accord with the needs of clinical neurology. Superficial critical sensibility was evoked by such stimuli as light touch, degrees of heat and cold ranging about the neutral point or skin temperature, and compass points simultaneously but lightly applied. Superficial affective sensibility was evoked by such stimuli as pinprick under moderate pressure, cold ranging from 22 to 0 C. and heat ranging from 40 to 55 C. Deep critical sensibility embraced pressure touch and its localization, posture and passive movement, size, shape, weight (passive), the compass points simultaneously applied with firm pressure, etc. Deep affective sensibility embraced pressure pain, and heat and cold in extreme degrees, for example, 0 C. to 55 C. in massive prolonged application. In brief, then, the theory of the mechanism of pain was as follows: In normal sensibility the critical system controlled the affective system of neurons in such a way that the anabolic and catabolic processes in the affective neurons were nicely adjusted to the needs of circumstance by supplying suitable threshold, etc. The materials requisite for the initiation and conduction of nerve impulses (kinetoplasm, etc.) were supplied in such a manner and to such an extent

as to meet in the best manner possible the requisite needs of normal sensibility. Lesions causing dissociation of sensibility, such as that found in lesions of the peripheral nerves, in the medulla spinalis, in the brain stem or in the thalamus, upset these nicely adjusted mechanisms by interfering with the control normally exerted by the critical system on the affective system. The immediate effect of such lesions was the appearance of pathologic tenderness and hyperalgesia. In all such lesions the affective neurons themselves were directly implicated anatomically or functionally. This interference acted as a stimulus inciting the remaining portions of the affective neurons and especially the neuron bodies in the dorsal root ganglia to hypermetabolism in the interests of restoration of functional and anatomic continuity. One of the by-results of such hypermetabolism was the spontaneous or readily elicited overflow of neural energy (nerve impulses) brainward. This was the cardinal feature of pathologic tenderness and spontaneous pains. These two principles underlay the theory of the mechanism of pathologic pain and tenderness—namely, (1) dissociation, functional or anatomic, of the critical from the affective system of neurons, and (2) hypermetabolism of the injured or liberated affective neurons. The pain and tenderness in themselves represented a regressive type of sensibility serving a purpose similar to that of such primitive protective mechanisms as the nociceptive reflex.

DR. FREDERICK TILNEY had thought a great deal about this theory of Dr. Byrne, but he felt that all were still in the realm of speculation in spite of the distance to which this theory had carried them. Over and above the findings of Head and his disciples, Dr. Byrne, in the first place, had brought forward a broader conception of the somatic sensibility as a whole in that he recognized very clearly that there were two distinct types of somatic sensory elements—the affective and the discriminative. Of course in their phylogenetic and biologic bearing they were very different in the purposes they served. The affective was presumably an extremely primitive type of sensibility. That had clearly led Head to his term of "protopathic." It was undoubtedly a part of a defense element, and the speaker agreed with Dr. Byrne in his limitation of it to the hurt element. It was in the defense sensibility that the muscles, joints and bones had their qualities of peripheral sensibility.

The second point was the recognition of the critical sensibility which prevailed in the various qualities of some esthetic features. That served a different purpose. That was not intended for a defense mechanism like the nociceptive reflex but served the purpose of a cognitive method of protection, maintained in a process or combination of processes in the cerebral cortex which one made use of in adapting various types of sensation to various skilled purposes. The recognition, then, of these two types of sensibility was a distinct advance. Ranson had proved that there were two sets of fibers, one of them of unmyelinated or scantily myelinated fibers and these probably mediated the pure affective elements.

Coming to the question of the thalamus, Dr. Tilney was not clear in his mind that one was not far over his head in the determination of this unusual relation of two axonal processes. He felt that the theory at this juncture however, offered a stimulus and an interesting outlook, but it was far from conclusive. There was a tremendous amount of work to be done before one could come to a definite conclusion. He believed in the main, that all were greatly indebted to Dr. Byrne for going forward as far as he had with his idea. It stood as an illustration of what a long, long trail lay here, but it would stimulate others eventually to reach its end.

DR. WALTER TIMME said that a few years ago he was interested in the cutaneous phases of sensory disturbance and, as these investigations in their final analysis depended on experimental methods of testing sensation, he turned his attention to methods of examining for sensation especially regarding the specificity of the power of nerves for carrying certain affective stimuli. In the first place, regarding the experimental modes of obtaining these reactions, he had yet to see a sensation of heat evoked clinically by any other means than pressure against the skin by a test tube containing hot water, or by other physical means. This brought two elements into the picture, pressure and heat. Heat was always accentuated if combined with pressure. The only true method was by radiation of heat without touching the skin and by this one would obtain a different response on the part of the patient. This might be done with a lens refracting the rays of the sun or of an arc light. If heat through this means was sharply and suddenly applied and then taken away the patient would not be able to distinguish between heat and a pinprick. Both produced pain. Specificity of conduction in this instance was therefore absent. Again, if one changed the focus of such a lens and allowed only the central portion to carry the heat to the surface, one would get a different effect from an experiment in which all the radiation was allowed to fall on the skin. One would get pain, and with an increased amount of heat in the second instance one might get no pain. Why was this? For the reason that there was no sudden change from one state to the other. If one put his arm in hot water he did not feel the heat throughout the arm; he felt the heat only at the surface of the water. The same with cold. The same with pressure as seen with mercury. Dr. Timme explained that he meant by this that one did not distinguish heat, or cold, or pressure, or touch, or pain as such, but only distinguished differences in these qualities; and it was the differences which produced in the end-organs in circumscribed areas these changes of sensation. No nerve or series of nerves could conduct a difference, and if one changed the degree of such a difference, reducing it from sudden to gradual, all pain would cease. Consequently, the same amount of pressure, or light, or heat, or cold might be applied to exactly the same end-organ as when pain was produced; and if done slowly no pain would be produced. This did not alter the value of Dr. Byrne's theory that at several levels from the posterior spinal ganglia upward to and beyond the thalamus these differences might be made the starting point of effective impulses, purposeful protective activity, probably through a marked difference of potential in the nerve current of adjacent ganglion cells.

Dr. Byrne, in closing, reminded Dr. Tilney that his conception of the relation of the critical and affective paths within the thalamus was so far based merely on physiologic studies, but he felt quite certain that such a relationship was fully justified by the facts. He had studied no less than ten cases of thalamic syndrome each showing that identical dissociation on which he had based his subdivision of the peripheral sensory nerves into four sets or systems, namely, *superficial critical*, *superficial affective*, *deep critical* and *deep affective*. Thanks to the labors of Dejerine, Egger, Roussy and their colleagues, as well as of Head and Holmes, the picture of a thalamic syndrome, more especially on the sensory side, was a very clean-cut entity. Dr. Byrne had had no opportunity to make postmortem observations on any of his thalamic cases. The nearest he came to such a consummation was at an operation performed on one of his patients by Dr. Alfred S. Taylor. In this case, which exhibited typical thalamic dissociation phenomena, a blood clot and a collection

of serum were found in the internal capsule about the level of the thalamus. Undoubtedly, the lesion had involved the thalamus in its ventrolateral aspect. Since Dejerine and Egger called attention to the thalamic syndrome early in the present century, only about twenty necropsies had been reported in the literature.

Regarding Dr. Timme's remarks on sensory tests, Dr. Byrne thought that most of these referred really to the critical elements of sensitivity rather than to the fundamental affective elements which include merely "hurt," "pleasure" or "change of state" without further qualification. The very essence of all stimulation of necessity implied a difference or alteration of conditions at the point stimulated. The statement that pinprick sensation was felt on the application of heat through a lens in one instance, and was absent when the position of the lens was altered, recalled observations made long ago in testing with pinprick, namely, that pain was felt at first, then there was a period in which pain was not felt though the stimulation was continued and later on pain of a distinctly different type appeared. It should be remembered that heat, and by this was meant temperatures above 45 C., was an adequate stimulus for pain. Indeed, recent work in the modern psychologic laboratories had corrected neurologists in this respect with good reason, for heat in the true sense of the word was not the equivalent of warmth. Heat was really a perceptual fusion complex derived from stimulation of pain points plus paradoxical stimulation of cold spots. This could often be demonstrated by testing the skin of the forehead at the junction of the hair, where, if a warm stimulus were applied, not only could warmth be detected but cold also surrounding or within the area of warmth. It was a fact that as tests were ordinarily made every kind of stimulus made appeal to several different types of receptor mechanisms. Thus, pinprick implied pressure as well as hurt, and it also implied an additional critical element, namely, sharpness which was perhaps more nearly related to pressure sensitivity than it was to pain. Both heat and cold also involved contact and pressure and for that reason in making tests patients should be drilled to reply in order to the three different elements, "touch, hurt, heat," etc., accordingly as each of these was perceived. Another point about these tests was that one's education so far as it was derived from sensory impressions was dependent not so much on refined forms of stimulus akin to those employed in psychologic and neurologic studies, as on grosser, more extensive forms incidental to the individual's daily contact with his environment. In some of the lesions of the central nervous system, as for instance in a case of syringomyelia studied by the speaker, the findings were such as to confute a good deal of what had been accepted by modern psychologists as orthodox regarding the four modalities, namely, pressure (touch), pain, heat and cold. The only differentiation between the various paths in the peripheral nerves which so far could be regarded as safely established, was that between the pathways mediating the fundamental affective elements (hurt, etc.) and the pathways mediating the critical or discriminative elements. These latter (the critical system) might or might not be capable of being further subdivided into separate systems served by separate end-organs for mediating separate modalities, but it was only the fundamental *affective system*, mediating the "hurt," etc., elements as such, which so far have been established as separate and distinct from all other afferent paths subserving sensation and which in combination represent the *critical system*.

Archives of Neurology and Psychiatry

Vol. I

MAY, 1919

No. 5

A MICROSCOPIC STUDY OF FAT IN THE CEREBRAL CORTEX *

OSCAR J. RAEDER, M.D.

Assistant in Neuropathology, Harvard Medical School; Assistant Pathologist to Massachusetts Commission on Mental Diseases.

BOSTON

Normal brains for histologic study are, in the nature of things, hard to obtain. In the first place, it is difficult to come to agreement on what constitutes a normal brain. Secondly, as Southard has insisted, the cells of a normal brain may purvey abnormal activities. Thirdly, of course, normal persons with supposedly normal brains for the most part live on through adult life.

The brains that have been perforce used are from general or special hospitals (cancer, tuberculosis or lying-in) or from accident cases, which latter are probably as near as possible to the ideal, only the previous habits of the individual fatally injured fade from the minds of interested persons, so that details remain obscure; but a brain from a young adult not insane, feeble-minded or criminal, non-alcoholic, nonsyphilitic or tuberculous, not the victim of chronic lead poisoning, electricity, acute or chronic infections, high terminal temperatures, who dies suddenly from accident (not shell shock) is preferred. This negative history is present in the first case reported in this paper (Special 6B).

METHOD OF STUDY

Provided one has a normal brain, what is the best way to get the most information from it?

Investigators differ in their methods of approach, but according to the present viewpoint of Southard, who emphasizes the importance of investigation of the nervous system by all routes—direct and indirect—one must include inspection, careful description and palpation of the fresh brain, with bacteriologic studies of its fluid in conjunction with the same record of viscera and cord. Further, the

*From Pathological Laboratory of the Massachusetts Commission on Mental Diseases, 74 Fenwood Road, Boston.

*Read at the meeting of the American Medico-Psychological Association, Chicago, June, 1918.

brain is multiphotographed after ten days to three months' fixation in 10 per cent. formalin — including surface pictures with pia on, then with pia stripped; also transverse sections are made and these photographed, and then sections for microscopic study are made of twenty areas in each hemisphere. This method was followed in the present study.

Perhaps sections from each gyrus would be ideal, but these at least should be made. These sections should be examined by the Marchi methods, with one or two modifications, also by sudan III, cresylecht-violet and Weigert methods, as detailed in the following. A study of these sections forms a basis for comparison with each other case that comes to attention.

WEIGERT'S METHOD TO SHOW MYELIN SHEATH DEGENERATION

1. Formalin fixation.
2. Mordant from one to five days:

Bichromate of potassium.....	5.0 gm.	
Fluorochrome	2.5 gm.	Cool and filter
Boiling water (distilled).....	100.0 c.c.	
3. Dehydrate 70 per cent. alcohol to ether, one day each.
4. Thin celloidin, at least three weeks.
5. Medium celloidin, four days.
6. Thick celloidin, two days.
7. Mount and cut (70 per cent. alcohol). Time may be saved at this point by embedding sections between thin sheets of celloidin. See Weigert's method for serial sections.
8. Mordant II—overnight in incubator:

Fluorochrome	2.5 gm.	
Water (distilled)	100.0 c.c.	Cool and filter
Boil and turn out flame		Use nothing but glass instruments
Acetic acid—36 per cent.....	5.0 c.c.	
Copper acetate (finely powdered)...	5.0 gm.	
9. Wash off mordant in water followed by 80 per cent. alcohol.
10. Stain twenty-four hours in incubator 37 C. in

10 c.c. Weigert's ripened (six months or more) hematoxylin (a 10 per cent. solution in absolute alcohol).
90 c.c. distilled water in which is 1 c.c. saturated aqueous solution of carbonate of lithium. Mix water and lithium together and add at time of using.
11. Wash in running water two hours or more.
12. Differentiate in—

Borax	4 gm.
Ferricyanid of potassium.....	5 gm.
Distilled water.....	200 c.c.
13. Wash in running water ten minutes or more.
14. Dehydrate in—

(a) 70 per cent. alcohol.
(b) 95 per cent. alcohol.
(c) 95 per cent. alcohol, 3 parts; carboxylol, 1 part.

- (d) 95 per cent. alcohol, 2 parts; carboxylol, 2 parts.
- (e) 95 per cent. alcohol, 1 part; carboxylol, 3 parts.
- (f) carboxylol, 10 per cent.
- (g) xylol.

15. Mount in Canada balsam.

CRESYLECHT-VIOLET STAIN

(For formalin* and alcohol—fixed material.)

1. If tissues have been in formalin more than two days, place in 70 per cent. alcohol three days (change after first day), and place in 95 per cent. alcohol four days (or longer).
2. Absolute alcohol, chloroform, chloroform paraffin—each one day.
3. Embed.
4. Cut at 6 micra.
5. Xylol (two changes), absolute alcohol (two changes), 95 per cent. alcohol, 70 per cent. alcohol, distilled water.
6. Stain in 1 per cent. aqueous solution of cresylecht-violet (filtered) forty minutes (incubator) or longer. Stain may be used several times.
7. Distilled water.
8. Differentiate in 95 per cent. alcohol, adding colophonium about ten parts (10 per cent. in absolute alcohol) if necessary (if alcohol has not been in wood), until background is white or nearly so.
9. Absolute alcohol (three changes).
10. Xylol (four changes).
11. Mount in balsam.

FAT STAIN FOR FROZEN SECTIONS

(Fix in formalin twenty-four hours.)

1. Cut sections on freezing microtome and place in 50 per cent. alcohol for from two to three minutes.
2. Place in concentrated solution of sudan III, or scharlachrot (in from 70 to 80 per cent. alcohol) for from ten to thirty minutes (better thirty minutes).
3. Take out and put in 50 per cent. alcohol until an even tawny shade.
4. Put in distilled water.
5. Counterstain in alum hematoxylin—one minute or less for nerve tissue, *ten minutes* for other tissue.
6. Wash in water until blue. (Section may not be but on examination the nuclei will be.)
7. Place on slide and then clear in glycerin and mount in glycerin.

MARCHI METHOD FOR STAINING FAT

1. Formalin fixation.
2. Bichromate of potassium, 2.5 per cent., from eight to fourteen days; change fluid at least once; keep in the dark.

* To secure best results a grade of formalin free from impurities should be used (for example, Merck's), and one should be sure that the tissues are placed in a fresh quantity the day after necropsy.

3. Transfer to osmic acid fluid:

Osmic acid, 1 per cent. (1 part).

Bichromate of potassium, 2.5 per cent. (2 parts) for eight days at room temperature, or five days at 37 C.; keep in the dark.

4. Wash in running water from twelve to twenty-four hours.

5. Dehydrate quickly.

Use 70 per cent. alcohol, four hours; 80 per cent. alcohol, four hours; 95 per cent. alcohol, twelve hours; absolute alcohol (two quantities), four hours; chloroform, four hours; chloroform paraffin, twelve hours.

6. Embed in paraffin and cut at 10 micra.

7. Clear in xylol (two quantities), one hour.

8. Mount in Canada balsam.

The material in this study consisted of three normal appearing brains.

REPORT OF CASES

CASE 1 (Special 6 B).—*History*.—The patient was an Italian, aged 27, married three years, father of three children and a mill-worker by occupation. He was an industrious steady worker, of a pleasant and even-tempered disposition, sociable and well liked by his co-workers. He was not alcoholic; there is no history of previous disease or venereal infection. According to his wife he had kept a gun under his pillow for *two weeks* and had threatened her. While asleep she shot him in the neck. He died, without moving, in a pool of blood. The necropsy was performed twelve hours postmortem, the body having been kept cold.

Necropsy Findings.—Trauma with fracture of the second cervical vertebra and hemorrhage in the neck. There was no evidence of disease or pathologic change in any of the body organs.

The brain was normal in appearance; it was preserved in 10 per cent. formalin solution.

CASE 2 (Special 41).—*History*.—This was a white man, aged 24, by occupation a farmer. He graded normal on the Binet-Simon intelligence test and his physical status showed nothing abnormal. The family, personal and venereal history was negative. The terminal illness was of twelve days' duration, with fever ranging from 99 to 104 F. with no mental symptoms. Death was caused by measles and bronchopneumonia.

Necropsy Findings.—The postmortem examination made one hour after death revealed acute changes in the lungs, kidneys and spleen. The heart showed right-sided dilatation and slight hypertrophy with early atheroma in the aorta and there was slight edema in the pia arachnoid. The brain weight was 1,720 gm.

CASE 3 (Special 42).—*History*.—This was a white man, aged 24, whose occupation was farming. He graded normal on the Binet-Simon intelligence test and was physically fit. Previous diseases were varicella at 17 and mumps at 19. Venereal history negative. The terminal illness was of fourteen days' duration with fever ranging from 102 to 103 F. There was presence of albumin and casts in the urine, but no mental symptoms. Death was due to measles and bronchopneumonia.

Necropsy Findings.—The necropsy was performed two and a half hours postmortem and revealed acute changes in the lungs, liver, kidney and spleen with moderate edema of the pia arachnoid. The brain weight was 1,430 gm.; it was normal in appearance.

COMMENT

The material therefore consists of three normal appearing brains of about the same age and the same sex.

In the first case (Special 6 B) there is no evidence of any somatic disease. There was only the trauma which caused death. The other two cases (Cases 41 and 42) are similar in many respects, namely, death was due in each case to acute somatic disease of about twelve days' duration. The terminal disease was the same—bronchopneumonia; and the fever ranged toward the end to 103 F. in Case 42, and to 104 F. in Case 41. Case 41 was two days shorter in duration, but the fever was 1 degree higher. In both these cases there was a slight edema of the pia arachnoid membranes. The consistency of both brain specimens was said to be normal. The somatic changes were similar—acute bronchopneumonia in both cases. Besides this there were acute changes in the liver, kidneys and spleen, and in Case 41 slight hypertrophy of the heart with some dilatation of the right side.

These brains were likewise preserved in 10 per cent. formalin. Twenty blocks were then selected for examination from each hemisphere to be examined microscopically after treatment with Marchi, sudan III, cresylecht-violet and Weigert staining methods, making forty sections of each brain or 120 in the three cases. This report deals with the Marchi and sudan III reactions.

METHOD OF EXAMINATION

The sections were first examined for fat pigment in the ganglion cells of the several zones of the cortex and then for changes in the vessels (Campbell's nomenclature). Results were tabulated for each layer of the cortex in each section, and comparisons made as follows: Between the different layers of each section; between the sections of one area with the other areas of the same brain; between the top and bottom, the front and back; between the external and central, and between the outside areas and included areas—as the transverse temporal.

Finally the cases were compared, area for area with each other. The areas in the direct path of arterial supply and venous exhaust were compared with those not so situated. The location, quantity, form and manner of distribution of the fat was studied within the cell. The fat in the vessels was studied in the same way.

FINDINGS

CASE 1 (Special 6 B).—Sudan III. *Cells*.—In the forty areas examined in this case the fat was found distributed as follows:

1. Beginning in the first or plexiform layer we find no fat.
2. In the second zone it was found in two instances.

3. In the third layer there were but three instances of fat pigment.

4. In the fourth layer there was a marked increase over the first three zones. Pigment was found in twenty-six areas out of the forty.

5. The stellate layer showed fatty pigment in but one area—the left lobus pyramiformis.

6. The sixth again showed a very general incidence, scoring thirty-one out of the forty areas.

7. The seventh or fusiform layer showed pigment in ten regions.

Comment.—In the order, then, of greatest incidence of fat pigment we have (1) the sixth zone with thirty-one; (2) the fourth zone with twenty-six, and (3) the seventh zone with ten areas involved; the other layers were affected a relatively negligible number of times or were entirely free as in the case of the plexiform layer. It is evident, then, that the larger cells are most frequently involved (Fig. 1).

Taking the stellate layer which is almost entirely free, as a dividing line, we find in this case that fat occurs thirty-one times in the suprastellate and forty-one times in the infrastellate regions.

TABLE SHOWING NUMBER OF TIMES FAT APPEARED IN SEVEN LAYERS OF FORTY SECTIONS OF EACH BRAIN

Number of Layer	Serial Number of Cases		
	Special 6 B (Case 1)	Case 41 (Case 2)	Case 42 (Case 3)
1	0	2	1
2	2	8	6
3	3	27	22
4	26	32	27
5	1	1	4
6	31	31	25
7	10	24	21

CASES 2 and 3 (Specials 41 and 42).—On account of the marked similarity in microscopic appearance these cases may be considered together: only in isolated instances do either Cases 41 or 42 compare more evenly with Special 6 B than with each other in fat content, and then only in a matter of degree.

In the first layer we found pigment in two areas of Case 41 and in one area of Case 42 compared with entire absence of pigment in Special 6 B. In the second zone we found it eight times in Case 41 and six times in Case 42. In the third zone we have a marked increase from Special 6 B—the apyretic case. In Case 41 pigment was prominent in twenty-seven areas and in Case 42 in twenty-two areas. In the fourth layer Case 41 furnished thirty-two instances and Case 42, twenty-seven. In this stratum Case 42 compares more nearly with the first apyretic case, but the difference between any two cases is comparatively small.

In the stellate layer one instance occurred in Case 41 and four in Case 42. So here, contrary to the fourth zone, Case 41 compares more evenly with Special 6 B, and Case 42 stands alone with a slight increase. The sixth layer is again more evenly involved in all three cases. Thirty-one areas in Case 41 and twenty-five in Case 42 showed fatty pigment. But here again, as in the fifth zone and contrary to the fourth zone, Special 6 B and Case 41 compare more closely, each showing thirty-one instances of pigmentation. The seventh layer is remarkable that in comparison with the first case it recalls the third layers. Case 41 showed fat in twenty-four regions, Case 42 in twenty-one regions, whereas in Special 6 B but ten areas could be said to contain fat.

Again taking the stellate as a dividing point we find here, contrary to the nonfever case, that the suprastellate layers contained more fat than the infrastellate, this reversal in the balance being due to the large increase in fat in the third zone. Thus we have pigment constantly present in the fourth and sixth layers in every case.

In the fever cases we have a marked increase in fat in the third and seventh zones with negligible increase in the second, and in Case 42 in the fifth layer. There was no considerable difference in the amount of fat in the individual cells of the fourth and sixth layers in the three cases. Thus in the fever cases the added amount of fat was demonstrated in the neighboring third and seventh layers. It would be desirable to study further the reaction of the cells in the third and seventh layers in similar acute conditions.

DISTRIBUTION, FORM AND QUANTITY OF PIGMENT IN THE INDIVIDUAL CELLS

We have found fat irregularly distributed in the cells, but in a general way, in the periphery. The nucleus is never displaced. In some instances the pigment is found bunched at one end or on one side of the cell, sometimes in the fundus, again encroaching on the axon. In other instances, it is more evenly scattered about the periphery of the cell. It is found in the form of minute droplets of varying sizes. The droplets do not coalesce, but keep their spherical form even when closely packed at a given point.

The quantity of fat varies but slightly in different cells in the same region, and comparing the areas we find no marked difference in the number of layers involved or in the fat in the cells from before backward and from superior to mesial surfaces. From above downward and inward (included surfaces) there is an increase both in the number of layers involved and the richness of fat in the cells.

The findings with the Marchi method duplicate those of the sudan III with added sensitivity (minute droplets in cells of all layers and in glia cells).

FAT IN VESSELS

Fat was found more generally in the vessels of the cortex, but less frequently in the white matter. The location of the fat in the vessels was in certain segments of the walls in the three cases, outside the endothelial lining and in intramural phagocytes. The endothelial cells were not swollen. The fat in the vessels was not found in droplets, but it seemed to coalesce and appeared in variously shaped and irregular masses, often at bifurcations or near branches, being irregularly distributed, some twigs entirely fat free. This irregularity may be correlated with the peculiar anatomic structure of the cerebral vessels.*

*Quain's Anatomy.

COMMENT

The question of all the integral elements in normal nerve cells is not here discussed. Many will question the value of the Marchi method for demonstrating fat on the ground of hypersensitivity. Neubach (quoted by Biondi¹), for instance, says any compound having a double bond of carbon will reduce osmic acid. The close duplication of the cell picture in sudan III which is soluble in fat would seem for optical purposes to be indicative that the nerve cells do contain pigment which stains by both methods. If we omit the completed discussion of variables which reduce osmic acid and those things in which sudan III is soluble, we can record freely the results of the application of these two widely known staining methods.

Mallory² states that "the presence of fat in the nerve cells is always a sure guide to disturbance of metabolism. In the cell body it must be distinguished from the pigment granules which are also stained by osmic acid but less intensely."

Alzheimer³ paid especial attention to the *location* of fat in the cells. In young adults he found it clumped in masses about the periphery of the cell, in the aged it was near the nucleus.

Biondi,⁴ writing in 1914, makes a notable review of literature touching on histologic studies of the nervous system with special reference to the lipoids, and emphasizes the presence of plastrozomes which the French authors believe are formed in albuminoid substratum linked physically or chemically with lipid substance. These lipid inclusion structures are either diffuse or granular in the normal nerve cells, but are absent in axons and dendrites and in the nerve cells of guinea-pigs and rabbits. It is generally considered that these lipid inclusions are products of cell metabolism of a regressive nature. He concludes that in all probability our technical methods are capable of demonstrating only a part of the lipoids of the elements of the nervous tissue and that another part escapes our histologic observation, also that the part which is demonstrable is variable.

Cotton⁵ in this paper states he has had access to thirty probably normal cases, six of which he reports on the microscopic findings, and

1. Biondi, G.: Lo stato attuale degli studii estologici sui lipoidi del sistema nervoso, Rio. ilal. di neuropat. Catania, 7:247, 1914.

2. Mallory, F. B.: The Principles of Pathologic Histology, p. 627.

3. Alzheimer, A.: Nissl-Alzheimer Histologische and Histopathologische Arbeiten, 3: p. 401.

4. Biondi, G.: Lo stato attuale degli studii estologici sui lipoidi del sistema nervoso, Rio. ilal. di neuropat. Catania, 7:247, 1914.

5. Cotton, Henry A.: Fatty Degeneration in the Cerebral Cortex in the Psychoses, with Especial Reference to Dementia Praecox, J. Exper. M. 22:492, 1915.



Fig. 1.—Photograph of a Betz cell from Case 1 (Special 6B), showing the disposition of pigment. The nucleus is centrally placed. Marchi method.

DRAWING TO SHOW PERIPHERAL PLACEMENT OF PIGMENT IN BETZ
CEREBRAL CORTEX IN YOUNG ADULTS

Plate 1.—(a) Drawing of a Betz cell from Case 1 (Special 6 B), showing the peripheral distribution of the pigment. Sudan III stain.
(b) Same. Marchi method.

PLATE 1

a



b

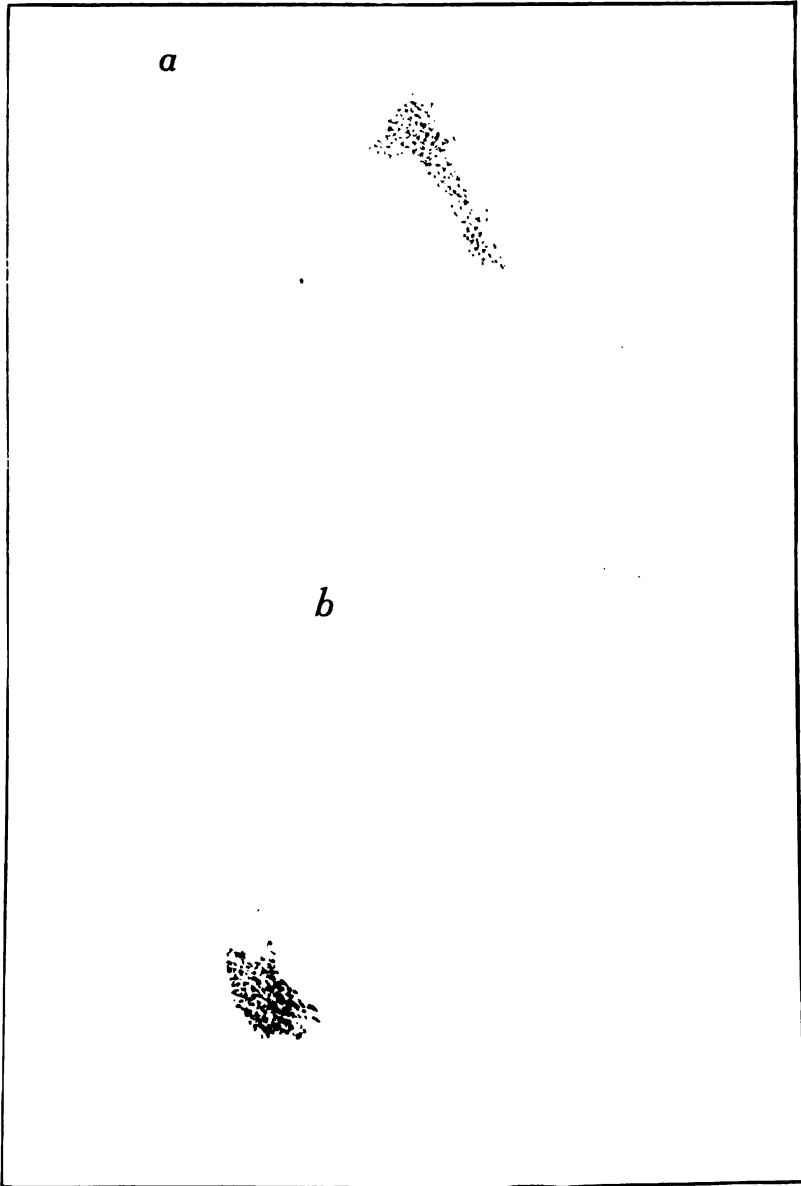


DRAWING TO SHOW PERIPHERAL PLACEMENT OF PIGMENT IN BETZ
CEREBRAL CORTEX IN YOUNG ADULTS

Plate 3.—(a) Drawing of a Betz cell from Case 3 (Special 42), showing the pigment at the periphery of cell. Sudan III stain.

(b) Same. Marchi method.

PLATE 3



states that in the new-born no fat was found in the ganglion, glia or cortex, and that in a boy, aged 16, killed by electric shock, there were small quantities of lipoid material present in the ganglion cells, but none in the glia or in the vessel walls; that a convict, aged 30, electrocuted, showed few (from 3 to 10) fatty granules at the base near the border in the ganglion cells, but the glia cells were negative. A negro, aged 27, electrocuted, showed no fat in the ganglion cells, and a patient who committed suicide, aged 36 (unhappy family relations), showed a small amount of fatty deposit. These patients under 40 years of age showed little or no fatty pigment, but in a man, aged 70 (circumstances of death not given), showed noticeably augmented lipoid pigment in the ganglion cells.

CONCLUSIONS

1. In three young male adults, not insane, gross examination of brain showed no abnormalities.
2. Examination of sections from twenty areas in each cerebral hemisphere stained with sudan III and Marchi's method showed fat present in some degree in nerve cells of all layers (Campbell's nomenclature).
3. Fat was found by far more frequently in the fourth and sixth layers — from 63 to 80 per cent.; the next most frequent location being the seventh zone — 25 per cent.
4. Fat was found in negligible amounts in first, second and fifth layers.
5. In the two cases with terminal infection there was a remarkable increase in fat in the third and seventh layers — from 53 to 65 per cent. — as against $7\frac{1}{2}$ per cent. in the third layers, and 25 per cent. in the seventh layer of the apyretic case. Higher temperatures affect third and seventh layers.

BIBLIOGRAPHY

- Reaction of Osmic Acid on Fat, *Enzyklopädie dev. Mikvscop. Technique*, **1**:446.
- Quinan, C.: Lipase Studies IV. On Regional Lipolytic Activity in the Normal Human Brain, *J. M. Res.* **35**:79, 1916.
- MacLean, H., and Williams, O. T.: On the Nature of So-Called Fat of Tissues and Organs, *Biochem. J.* **4**:455, 1909.
- Bullard, H. H.: The Microscopical Demonstration of Fats in Tissue Sections, *J. M. Res.* **37**:55, 1912-1913.
- Bell, E. T.: On Different Stain of Fats, *J. Path. & Bacteriol.* **19**:105, 1914-1915.
- Schaefer: Textbook of Physiology.
- Fischer and Hooker: Fats and Fatty Degeneration, 1917.
- Cowdry, E. V.: The Structure of Chromophile Cells of the Nervous System. Contribution Embryology, Carnegie Institute, Washington, **4**:27, 1916.
- Bang, I.: Pathology of Fats and Lipoids (Abstract), *Brit. M. J.* **2**:382, 1913.

Laignel, Lavastine and Jonnesco: Dégénérescence lipoidique de la cellule Purkinje, *Compt. rend. Soc. de biol.* **33**:52, 1912.

Boas, I.: Ueber einen Neuen Fettfarberstoff, *Verhandl. d. Berl. med. Gesellsch.* **42**:289, 1912.

Wright, J.: A Contribution to the Fats and Lipoids in Animal Tissue. IV, The Ring Bodies and Their Significance in Vital Processes, New York *M. J.* **93**:764, 1911.

Smith, J. L.: The Staining of Fat with Nile-Blue Sulphate, *J. Path. & Bacteriol.* **15**:53, 1910-1911.

Eisenberg, P.: Ueber Fettfärbung: farbchemische und histologischtechnische Untersuchungen, *Virchows Arch. f. path. Anat.*, p. 502, 1910.

Dietrich, A.: Zur Differentialdiagnose der Fettsubstanzen, *Verhandl. de deutsch path. Gesellsch.*, p. 263, 1910.

Ciaccio, C.: Contributo alla distribuzione ed alla fisio-pathologia cellulare die lipoidi, *Arch. f. Zellforsch.*, p. 235, 1910.

A PSYCHOLOGIC STUDY OF STEALING IN JUVENILE DELINQUENCY

L. PIERCE CLARK, M.D.

NEW YORK

In the present paper no attempt will be made to consider the so-called benign types of ordinary stealing, as these are more or less conscious and purposeful acts common to many individuals of all ages. Nor will special emphasis be placed on fanciful stealing such as the kleptomaniacs, where the objects stolen are often of highly symbolic significance such as studied originally by Krafft-Ebing,¹ and more recently by Stekel,² Albrecht,³ Riklin⁴ and Pfister⁵ as manifestations of neuroses, and by Gross⁶ as a compulsive act in a manic-depressive, or by Chlumsky⁷ and Sommer⁸ in feeble-minded persons whose defects were either inherited or acquired. The few cases which will be reviewed here are confined to persons who have stolen money or other valuables without the ordinary patent motives of simple covetousness or revenge, and who often find themselves overcome by the temptation in face of the apparent knowledge that the act is wrong. Purely as an impulse the act is not so very dissimilar to that of fanciful kleptomania, nor is it often essentially different from the purposeful stealing of everyday occurrence as found in poorly inhibited individuals. On the whole, one may say that the main characteristic of the persons here considered is stealing money and consciously committing other antisocial acts of a petty sort mainly as a consequence of having no well grounded sense of property rights. Usually these individuals show predominantly many other poor adaptations to authority and law from earliest life and they appear unable to thoroughly grasp the importance of making the proper submission and compromise with parental discipline. I think it must be freely admitted by every one that the whole problem of the cause of stealing as an antisocial trait in juvenile delinquency is still in a chaotic state. There are

1. Krafft-Ebing: *Psychopathia Sexualis*, ed. 13, 1907.

2. Stekel: *Nervöse Augzustände und deren Behandlung*, 1908 and 1912.

3. Albrecht: *Zur Psychologie der Kleptomanie*, *Zentralbl. f. Psychoanalyse*, etc., May, 1913.

4. Riklin: *Zentralbl. f. Psychoanalyse*, 1911.

5. Pfister: *Die Psychoanalytische Methode*, 1913.

6. Gross: *Das Freudsche Ideogenitätsmoment und seine Bedeutung im manisch-depressiven Irresein* Kraepelin's, Leipzig, 1907.

7. Chlumsky: *Vierteljahrsschrift f. gerichtliche Medizin*, 4: 1892.

8. Sommer: *Diagnostik der Geisteskrankheiten*, Vienna, 1901.

some investigators who look for the root of these trends entirely in the make-up of the youth himself; they count him either a moron, a subinhibited mental defective, or a constitutional psychopathic inferior — whatever that term may just mean. Others greatly favor the idea that the parents and home environment are largely responsible for the development, if not for the actual implantation of the unruly or unmoral traits of character. Usually neither group neglects to thoroughly indict the family stock for the delinquencies found. They find in the family history certain vague though pertinent psychic or neuro-pathic traits, and, failing to discover a proper cause for the delinquency per se in the life history of the youth or his immediate environment, they apparently employ the heredity factor as a last resort. No sooner, however, does one undertake to investigate a series of such youths than he is impressed when all the above views are requisitioned to interpret juvenile delinquency, there are many more subtle forces at work than those usually obvious on the surface. Some of these obscure causes may be illustrated.

Apropos to our present study are Healy's⁹ investigations of mental conflicts and repressions in delinquent children. He analyzes the acts of stealing money to sex delinquency and the incomplete mastery of the latter. For instance, one of his cases, that of a boy, was taken from his home environment and evil companions and was cured of his delinquency. Apparently, Healy's case was a conversion or substitutive mechanism of lying and stealing, the result of unsuccessful attempts to repress the sexual trends. In a long series Healy found surprisingly often concealed sexual conflict as well as defects in parental discipline and lack of proper filial-parental relations. He also cites several cases in which mental conflict grew out of the child's discovery from outside sources that a previously supposed parent was not really such. However, he does not specially mention cases in which antagonism to the father and desire for childish revenge on this parent was a cause for stealing as shown in my cases.

ILLUSTRATIVE CASES

CASE 1.—A boy of 15 was recently seen by me at the request of one of the visiting teachers of the Board of Education. He played truant from school and stole, and had done so for several years—in fact, ever since his father deserted the family. The mother herself had become embittered because of her marital troubles and went to live with her mother. Soon after the boy, when 11 years, stole so much from his grandmother and her immediate family that he and his mother had to go elsewhere. The boy's great fault was in concealing his thoughts and various daily activities from the grown people, and he was always uncomfortable in the latter's presence. In fact, he was

9. Healy: *Mental Conflicts and Misconduct*. Little, Brown & Co., 1917.

most secretive in any inquiry about his whole life. After the more obvious faults in the home and school were set right and the boy permitted certain liberties and pleasures, his conduct improved; yet he did not obtain a good vigorous activity or proper adaptation to parental authority. He still lied and was sly. When made to join the church choir he stole from the church, and when forced to attend a special school he stole from that.

A frank talk with this boy showed that he failed to make any good compromise with discipline and authority. Unfortunately, with only a partial reconstruction of habits in progress, the boy was lost to view. It was learned later, however, that he had never adjusted himself to the father's authority; when the father deserted the family the boy failed to adjust himself to his mother, who beat the boy even more unmercifully than his father. Finally the grandmother treated him even more strictly, and he stole and otherwise showed dilapidated conduct in her home until he and his mother were obliged to leave. The boy apparently was not consciously clever enough to know that his stealing brought about the separation.

CASE 2.—A boy of 10 who was the recipient of whippings administered by his father had sharp conflicts, and first began to steal from the father after punishments at 8 years. Gradually he grew sullen and revengeful. He then began to steal from the proprietor of the delicatessen store where he worked. The proprietor undertook severe discipline also. At 10 he stole from a teacher who was strict with him and whom he specially disliked. In this instance the conflict with authority was all quite conscious and easily reprieved by adjusting the home and school life.

CASE 3.—The next instance is one of incorrigibility and stealing in a girl, aged 13, much like a series of cases reported by Dr. Healy. She began her disobedience and stealing at 11, soon after a playmate tried to induce her to go to the parks with boys and get money from such associations. She refused, yet wished very much to have the money to spend which her evil playmate displayed. She underwent mental torment in this moral conflict, but finally repressed it and became delinquent and stole only when she failed to be promoted in her class. She then took small sums of money whenever she came across them. The child says, "Father, mother and teacher say 'Don't,' 'You mustn't,' and then something inside tells me to be bad and steal. If I wanted to I could be the brightest girl in school. I took things probably once a week—about as often as the other girls went to the parks with boys, but I never went with the boys."

A case in which the causes for the delinquency were more complicated and seemed in part due to inability to properly adjust to the revolt at puberty may be cited in outline.

CASE 4.—An only child, now 19 years old, unexpectedly underwent an entire change of personality at puberty. Previously he had been sweet-tempered, obedient and affectionate. At 14, he "flared up" and declared he would no longer attend Sunday school. Immediately after this "astonishing rebellion" he insisted more or less on having his own way, and became smart and cocky. He not only revolted against parental authority but behaved in the same way toward the head master at private school. Induced to join the church he began to lie, refused to study, and at 17 was incorrigible and sly. He was expelled from school for theft. When taken to task for his misconduct he was indifferent, "as though he possessed no moral sense." When asked the

reason why he stole he said the other boys had lots of money to go out with the girls but he hadn't, and one could not properly entertain them without money. He then insisted on leaving preparatory school and going West, even forfeiting prospects of an inheritance by so doing. He was finally allowed to go West, and was apparently doing fairly well at an inferior occupation when he was again placed under the guidance of church influences, and he again became dissipated and negligent of his personal and social obligations. He lost his job and drifted about from one position to another, losing them largely because of carelessness and indifference to his work. The minister and other persons connected with the church who had been looking after his welfare, while away from home, washed their hands of all responsibility and soon after this he "braced up" and secured a job of his own finding. He now writes his parents that he has learned his lesson, is willing to come home and settle down to work and abide by the regulations of home and school, adding that he is *willing to do just exactly as father directs.*

Comment.—Here we find the first inability to adapt to the parental authority at being forced to go to church and when he was forced further to join the church his moral dilapidation was quite complete; and though he did fairly well "out West," he broke down again when the guidance of the church was reintroduced. Probably the moral inhibition superadded to the parental direction was the main cause for breaking down his good social conduct. Apparently this case is a common one of revolt at puberty. The very closeness of filial-paternal attachment in early childhood made the revolt at puberty the more violent. When the revolt was coupled with sexual repression and difficult adaptation to this social and antisocial demand, he extended his dilapidation of conduct to lying and stealing as well as incorrigibility and truancy. The final outcome is not yet, although the boy seems to be on the road to making a proper adjustment, a compromise with the home authority, and has expressed his willingness to abide by the rules of society. It may be added that this young man has very recently entered a noncombatant part of the governmental activities, but shows still an incomplete social adjustment but has so far as known stolen nothing for the past two years.

One of my cases, a woman about 24 years of age, seems to be analogous to the case reported by Dr. Glueck of a latent homosexual complex.¹⁰ Again, as in the previous instances, the final analysis cannot yet be supplied. The case, however, is worthy of more extended study, which will be attempted.

CASE 5.—The girl was a fairly clever paid worker in a social settlement. Her appearance was pleasing, her work in general good, and everybody liked her. She stole only from women, and those, too, were her best friends. So gracious was she in her conduct in spite of her peculations that not only did she continue to be very fond of her victims but they reciprocated her affections. In consequence, inquiry had to be undertaken with greatest delicacy lest all parties concerned might have their "feelings" hurt. It was only after a perfectly impossible series of thefts that "all hands" agreed to a partial psychology investigation. The girl's old family nurse reported that she showed no special peculiarities in childhood, learned easily and stood high in her studies.

10. Glueck: "Studies in Forensic Psychiatry," Little, Brown & Co., Boston, 1916, p. 239.

Her education was interrupted at the end of her first year at college by dismissal on account of theft. She had a short, benign attack of chorea at puberty.

As a young girl she had normal powers of observation and concentration. She was quick and impulsive and was said to have been too ambitious to attain physical and mental vigor for her physical endurance. She was practical, active and serious-minded, bashful in the presence of men, but friendly and affectionate with women. She was sympathetic, kindhearted and generous with girls. She resembled her father in physique and her mother in temperament; for the latter she has always shown decided preference. In general, she had a keen moral sense. She always showed emotion when detected in taking money, putting her arms about her victim and crying in apparent genuine concern. She spoke frankly about her thefts from her "dearest friends" both at college and in business associations. She claimed to have stolen first without cause, but soon claimed it was really to help her invalid sister, but later thefts lacked this motive. In fact, she now has an income from inherited property as well as drawing a salary, and is at a loss to account for her thefts. She volunteers the statement, "I never have cared anything about men, but am deeply interested in girls. One college friend from whom I took small sums was like my business associate, of whom I am now very fond." When pressed rather closely she says, "Yes, I suppose these girl friends do have great influence over me. I feel nearer to them than to my mother." This last was said with the emotional stress of one speaking of affections stronger than ordinary friendship.*

I think one may safely infer when the act of stealing occurs without apparent motive, at least sufficient for the offense as ordinarily found, that it is probably unconsciously conditioned either on a defect in adaptation to authority, to sexual conflict and repression at puberty,

* It is interesting to see what becomes of these patients under a system of wise care and attention by lay individuals. The following letter recently received explains in part, and is written by a woman conducting a girl's school in Massachusetts:

"On visiting New York just at the time of the difficulty this girl had experienced, she told me it was her intention to 'drop out of sight,' this after her detailed account of her trouble. She decided to return with me, and for three months my anxiety for her was great. I kept her with me continually, never alluding to her life in New York and keeping her confidence strictly. Feeling that she must have some interest in something radically new, I arranged with a teacher at one of the physical culture schools to have her take a course of study. She took the two years' course, and I arranged that she apply the knowledge she had obtained in our own school. All the time for more than two years I kept in constant touch with her, never permitting her to be far from me and giving her all the love and care I would my own daughter. Away from her father, she has developed honor, established a habit of truthfulness, and is now a trusted helper."

Undoubtedly the sublimation, possibly a homosexual transference, seems to be working satisfactorily. However, a more genetic rationalization of the real unconscious motive should be given. Finally, one may say in this case that under ordinary conditions perhaps this girl will not break down into her old delinquencies.

or it is a vicious homosexual theft-substitution for the offender's own sex, as in this last instance.

SUGGESTIONS AS TO TREATMENT

The line of therapeutic procedure is obvious in all the foregoing, that is, explanation by analysis, conscious guidance, and a sympathetic after-care and training. The enormous demand and difficulty of sublimation in the homosexual victim of the theft habit, makes correction extremely difficult. In fact, it is to be doubted whether the homosexual is ever able to sublimate sufficiently to keep him from social conflicts, or from a neurosis more or less dominant throughout his life. His task of adaptation must be so enormous that his life is destined never to be a contented or happy one.

I cannot too forcibly insist on the importance of studying the child's *adaptation to parental authority* when delinquency and stealing begin at a very tender age, as a basis for adjustment to all law and order in the future life of the individual. An example which exquisitely illustrates my thesis is the following, given at length.

DETAILED REPORT OF A TYPICAL CASE

CASE 5.—History.—The case is a rather common one in its clinical expression, and is that of a young man in middle adolescence. He had a fairly normal physical and mental development up to 5 years of age, when he more or less abruptly began to lie and practice deceit. Soon he began to take all sorts of things which did not belong to him—knives, scissors, thimbles, and various objects he found lying about the house. He had been neither a sensitive nor a passionate-tempered child in infancy, and as he grew up he was quite obedient to the home discipline under ordinary circumstances. The father tried to correct his lying and stealing by talking to him, but, in the father's words, "he did not seem to grasp the full import of these talks nor did he seem to realize that he could not have anything he wanted whether it was his or not." After the father's talks and mild physical punishment the boy was "terribly sorry," and would show no further misconduct for weeks at a time, when he would relapse to his former misbehavior. The parents hoped he would "grow out of it," and thought his unusually rapid growth had something to do with his moral delinquencies.

At 9 years he was nearly 5 feet 4 inches in height. From 5 to 9 years of age he had been a fair student at school, but his studiousness had gradually decreased until his main interest in school life was in athletics with the boy group. He became hyperactive and wanted to be constantly on the move. He had little patience with his teachers and practiced all the quieter forms of deceit and chicanery of the poor student. His growth continued to be rapid, and at puberty he was nearly 6 feet in height. His lying and thieving propensities grew *pari passu* with his years, and as he grew older he coveted things of more importance. When his delinquencies were found out he appeared as remorseful as ever. His moral defects clouded the activities of his daily life but little until puberty; he then began to revolt at the school discipline although outwardly he appeared to be a fairly well behaved boy.

He was changed from the grammar school, where he had grown quite unruly under a woman teacher, to a private school with a capable male instructor, but made little change in deportment. He stood well with his boy companions in spite of the fact that he helped himself to their wearing apparel and other personal belongings; no special deceit was resorted to in these misappropriations. When taken to task by the head master for a larger theft he played truant and tried to lie out of it. Once he fooled both his parents and the head master for a week's nonattendance at school. He steadily lost ground in his classes and was put back, but these inability to progress seemed only to lessen his ardor for a school career. Otherwise his hopes and ambitions in life were much like those of other boys of his age and station.

At 14, when rather severely taken to task he ran away from home, leaving a "touching appeal" to explain his disappearance. He was soon located in a neighboring city and brought back home, apparently quite willingly. Soon after this episode he had an attack of chickenpox which caused him to lose six weeks at school. While convalescing he had two fainting attacks (probably due to anemia); the restrictions entailed in caring for his full restoration to health caused him to fail in his examinations, although he was warned that this might occur. A few days after this failure in promotion he eloped from school, borrowed a horse, and, dressed in a sort of cowboy wild west outfit, wandered away in the country. He took no special pains to conceal his itinerary or his whereabouts. When trailed and found three days later, he was living in the wilds, had a tent and was paying, begging or stealing for his necessary articles of food. He had borrowed the horse for a day, and when it was not returned search led to the boy's apprehension. He seemed not to recognize the gravity of his failure to return the horse, and acted rather callous and unfeeling about the whole matter. Only when pressed rather sharply as to the details of this escapade did he lie, a rather common reaction when he was cornered.

Comment.—The foregoing brief summary was duly verified from several sources at the first examination. The boy was found to be a great hulking fellow, much in advance of his years. Although physically and mentally restive under examination, he was apparently frank but rather affectless in going over the history of his delinquencies. His eyes, usually shifty, would light up with boyish enthusiasm as he unfolded a rather plausible scheme for his future life and ambitions, which was to go to Texas and take up ranch life under the direction of an old friend of the family.

Examination.—The physical examination was completely negative. Mental tests showed this youth to be clever and resourceful; he had a logical memory with no mental defect; he was about three years in arrears in his school studies but in advance of his age in performance tests. His lack of interest in school made his attention and power of sustained concentration on his studies poor. He had a very clever ability to use tools, was quite an expert garage man, and drove the family automobile. He was self-reliant. He easily learned to swim, dance, and shoot. He was easy to get acquainted with and had the faculty of making many friends, but was not over-particular in his choice of companions. Persons engaged in outdoor activities he chose to cultivate particularly. He was always rather egotistical and wanted the spotlight on all his athletic acquirements. Even as a young child he wanted his own way, and used to tease a good deal to get it. As a boy under 5 years of age, after listening to especially exciting narratives of adventure he would be restless in sleep, had nightmare, dreamed of Indians and of being chased

by snakes, etc., but for several years he has had no remembered dreams and sleeps "like a log."

On being asked how he handled the home discipline, the boy remarked, "When things didn't go well, and they sort of knocked me down and out, I frequently thought of running away and earning my own living. I took but one flight, and I enjoyed it." When he is plotting to do something, or has done something he ought not to, he talks very fast and volubly, sparring for time to find a way out. He chiefly craved the sympathy of his mother, his sister, and the old family cook; the latter, especially, gave him money for his various escapades as a child when the father objected.

Conduct While at School.—A digest of the opinions of the head master of a preparatory school regarding this boy a few days after my preliminary examination of him is as follows: "I am very sorry to say that the boy failed in his entrance examinations pretty hopelessly in both algebra and English. We did not expect much, of course, on the technical written papers: his entrance examinations consisted, therefore, principally of an effort to determine whether he was ready to buckle down to good, severe work. I am sorry he did not pass this test either. He manifested considerable interest in stock, which is a subject for our seniors only, and said frankly that he would like to ride a horse, but didn't care much about wielding a hoe, and that he hated chickens. I told him the question was whether he wanted to take off his coat, and get down with the boys of the first class, who were younger than he, and really get a thorough foundation and go right through the whole four years of our agricultural course. He seemed to feel a little hurt, that I thought he was unwilling to hustle; but the impression he made on all of us was rather that of a somewhat elegant dilettante. He hired an automobile to bring him over the short distance from the station, and in general seemed somewhat of a kid-glove farmer. However, we felt that he was something of a good sport in that if he got roused he might put the work through rather than quit. At the same time, he showed no real or vital interest to do anything except the small part of our course that happened to be of interest to him. As there were enough boys to fill up our enrollment who did very much better on our technical examinations and showed a more willing spirit, we felt, naturally, we ought to take them and reject this boy."

Subsequent History.—A short while after this poor showing, the boy was placed in the training camp to be under close observation. He made good contact with the other boys but frequently took their ties and canes without asking permission. He neglected his studies and crafts work to talk and walk with girls at a neighboring hotel, but while with them his deportment was quite correct although somewhat "rattlebrained" and "kidlike."

After the first two weeks of minor delinquencies at the club camp, he took on two occasions a fair sum of money from the clothes of some of the summer guests near the camp. It is interesting to note the final confession the boy made of his temptation and final downfall in the theft. "For days I had been thinking about money, especially at night when I would go to bed. I thought of all the good things I could get. It was all selfish on my part. I wanted to purchase candy, pipes and cigarettes, and neckties for myself. For several nights I thought this all over. I thought that the bath-houses would be pretty easy and then I thought how wrong this was, and for a couple of nights I put it out of my head and then it began again, for no particular reason that I know of, because I did have some money with me. I went to

the bath-house one day and saw the door open and took the money I found in some clothes there. Then I saw that I got away with this, and went in again on another day and took more money. At first, I would see the door open and then walk away because I would think how wrong it all was, and then something would come over me, like a wave, and I would put the thoughts away about it being wrong and would then go in and take the money. I never thought of the legal consequences and don't think I ever imagined I would get caught. I had no antagonism against the men I took the money from—in fact, I didn't know one of them at all. I thought if accused I would bluff it out, and I tried that but it failed; then I felt sorry and ashamed. I don't think the idea of spending money on the girls had anything to do with it—it was all for myself." While the boy gave this information frankly, and with downcast eyes, he did not seem to appreciate the seriousness of his offense at all.

After the foregoing episode the whole series of delinquencies were gone over in minute detail, especial inquiry being made on the first remembered act at 5 years of age. It was difficult to get the patient to submit to a painstaking scrutiny of his early life at first. Finally, the acts of stealing led to the early conflicts with the father about punishments for disobedience and lying. At the outset of his initial acts of disobedience he argued with the father regarding the injustice of the punishments, but later when silenced by the father he grew sullen and had a "hang dog" expression. Still later, after other acts when requested to explain he refused to make any defense, excuse or apology. As he said, "I thought I had best take the punishment coming to me and get the matter over as soon as possible, which I did." Further association on his acts and the rights of property in particular brought out the statement, "Why, you see when I was just a little kid I got the idea that all the property in the house as well as everywhere else belonged to father. If he didn't actually own it, it was subject to his control or disposal." It was shown further that even the more intimate belongings of the mother, such as scissors, rings, thimbles, etc., were really the father's and that when he took things he felt that his father would have to pay for or replace them. When he received punishment he never went to the mother for consolation but to the old colored cook who had been in the family employ for so long that she had taken the family name. As a child he went to her for sweets and all sorts of special favors which she was only too glad to furnish. The boy was the oldest and for a long time the only child in the family. Occasionally the cook sided against the boy and agreed that the father's discipline was right, and after a long talk and some "sweet blandishments" he became reconciled (outwardly) to the father's punishments. Further, it was shown that the boy practically took money or other property solely from the male sex. In one instance he stole a half dollar from the cook. When taxed with this apparent ingratitude the boy hastily added: "But I knew father would have to pay her back and a little more for all her kindness and pains in bringing me up. You see, I sort of looked on the cook as my mother in spite of her being colored."

As he grew up his rebellion against authority was shown to be really against the father. He said, "Some of the people who had authority over me at various times looked like father, especially the school master and Mr. X.; both treated me very nice and acted just like a father to me, and I took the most from them. After I took the money from Mr. X. I felt as though he had done something against me, instead of the reverse, and I

never wanted to go with him after that." From the age when he first began to steal and lie, he used to say he didn't want to be like the father, did not want to follow his profession, nor even engage in indoor work as the father did. He then began to plan to go away to lead a "wild, care-free life, away from all restraint." The man from whom he last took money was one whose son was also under strict authority—a fact which may be taken for what it is worth.

The possibility of there being a latent father antagonism was entirely overlooked at first, inasmuch as the father and son are at present the best of friends and "pals." They shoot and swim and go off on vacations together. Even the day after mental analysis had been fairly gone into, our patient showed me a letter to his father pleading for him to give him the right to go West at once, and ended with a playful threat that there were many ways to get money and a chance to go if the father should refuse.

Results of Treatment.—Associated with and following the foregoing analysis on the stealing and lying impulses, the youth was given ethical talks covering every phase of his previous misconducts and their consequences. Gradually an entire change in attitude and character took place. Now, several months after the analytic and training treatment, he has paid up all his old debts and has reimbursed his father for extra outlays in his behalf. He has voluntarily given up a desire to go West, has taken on a tutor and is working hard to enter a technical school from which his father was graduated, and is no longer unconcerned or careless in his daily conduct at home.

Comment.—In brief, then, we have here a boy who at the early age of 5 rather abruptly came into conflict with paternal discipline although the latter seemed to be not unnaturally or too severely administered. In sequence to this rebellion which was both suppressed and repressed, he developed a keen antagonism to the father and soon after began to lie and steal and assume other unethical traits of character. The habit of stealing continued until advanced adolescence, until corrective measures of training, away from the home environment, plus mental analysis were applied. The latter covered many interviews over a period of three months. At first, the boy met the analysis by an affectless indifference, but so soon as the real difficulty of defective adaptation to the father's authority as a child was made manifest and its later conscious contrast of seeming rapport with the father, the emotional reaction was intense. The analysis was never truly psycho-analytic but rather that of an intensive review of the foreconscious.

The investigation was, however, much more thorough and dynamic than that ordinarily given to such conduct disorders. Here, as in other instances, one is often impressed that the defective primary instinct acts as a sort of latent psychic infection which in time, as new adaptations in development are encountered, undergoes many transformations both in degree and kind. For example, the boy began with disobedience, then lying when hard pressed; next, he stole to get square with the father. Later, we find the school authority seemed to induce inattention to study and corresponding increase of desire to keep up and enlarge the chances for sport and play. The latter in turn necessitated more lying and deceit. Finally the previous defective adaptations engendered truancy and insubordination which passed over to vagabondage. Thus we see the mental conflict to correct the character faults was almost over. The don't care and affectless attitude of the incorrigible delinquent and final crystallization of the antisocial recidivist was about to be adopted when the correction was undertaken.

Ancestral History.—A word might be said regarding this boy's antecedents. The maternal grandfather left his family and led an antisocial life. The mother seemed inapt in handling children and rather slow in delicate appreciation of her duties and obligations in rearing them. Least of all did she understand wayward and headstrong boys. Her general attitude toward the inculcation of nursery ethics was poor and colorless. This son therefore easily found an early and warm attachment to his foster mother, the cook. The father left nothing wanting in his parental attitude toward the boy save an unusually lively temper and a quick and unsteady control over him, which seemed to make for the boy's ready belief that his father's talks were either bluffs of threatened punishment or that he was unjust in overawing the boy's attempts to set matters right in explanation. It may be of interest that the siblings of the boy himself were most normal physically and mentally and there was never the slightest moral difficulty with them. I may add at this point that there were no very serious sex delinquencies in this boy.

PRACTICAL CONSIDERATIONS

It may not be illogical to argue that from resistance to authority to theft, when found in the developing child, is not such a far cry when we look at the subject from the child, and not the adult, level. For instance, sufficient data are at hand for us to state that in the infant mind one of the earliest conceptions of reality is impingement of its desires by the parent. The magic signals of crying and gestures do not move the parent to gratify the child's wish. In the persistence of this feeling of unrequited longing, no doubt the child begins to scrutinize with continued wonder the reason for noncompliance on the part of the parent, and more or less rapidly interprets it in terms of selfishness or the self-satisfied possession of things and powers which enable that person to calmly resist all the child's frantic demands. Possibly it first sees that the very bigness of the parent lends strength. Soon, however, the personal belongings are also taken as symbols of the parent's potential self-sufficiency. One of the first acts of mimicry the growing child adopts is to deck himself out in the parent's wearing apparel. Thus equipped, it is the child's happiest concern to play the rôle of the parent, especially its authority vesture—tyrannical or beneficent whichever it may be. Balked by reality, the child's impulses are frequently gratified, perhaps secretly, in his play in the attic or barn. It is not a far step to the further exercising of power for the child's satisfaction in gratifying its personal appetite, in stealing fruits or committing forbidden excesses which he believes the parent has unrestrained opportunities to enjoy. If the child's lust for pleasure is sufficiently overmastering, this seizing of the parental power and privilege advances to new forms of covetousness and conquest, which may be that of possessing the magic symbol—money. It soon finds that money is really the easiest method of getting what it wants

rather than barter as in the manner of simple or primitive exchange. What is easier to imagine than that the unrestrained or poorly adjusted childish demand, perhaps repressed by the strict discipline of the parent, strives in some devious way to lay hold of the actual coveted possessions of the supposed favored one—the parent—who as he believes takes pleasure, or at least is indifferent, to the child's own ungratified longings.

CONCLUSION

In conclusion, I may say that even when the child's defective adaptation to authority and property right are made clear, there are probably other and still more genetic reasons for this early conflict, namely, the latent infantile desire to usurp the place of the father or the mother in all its possible prerogatives. One need not neglect the study of the adult life of criminals, and especially the causes for recidivism, for even there the adult pattern of the anti-social acts will probably be found to embrace in greater part the distorted mechanism of the primary instincts of early life. I but wish to add my suggestions to those hopefully made by Healy and Glueck, that the intensive study of antisocial behavior of the juvenile delinquent and especially in earliest childhood may enable us to correct not a few such faults before a fixed formation of habits and character has rendered the offender so hopeless for reconstruction in adult life.

PERIPHERAL NERVE INJURIES

GEORGE E. PRICE, M.D., HENRY O. FEISS, M.D.

Majors, M. C., U. S. Army

AND

WILLIAM B. TERHUNE, M.D.

First Lieutenant, M. C., U. S. Army

AMERICAN RED CROSS MILITARY HOSPITAL NO. 1, A. E. F., FRANCE

INTRODUCTION

Injury of peripheral nerves is the most frequent and important organic neurologic condition occurring as the result of war. These injuries have been carefully studied by the staff of American Red Cross Military Hospital No. 1, formerly the American Ambulance. The purpose of this paper is to place on record the methods used in caring for peripheral nerve cases in this institution and to report the results following nerve suture.

This hospital, founded Sept. 4, 1914, opened its doors with sixty beds devoted to the care of French wounded. This capacity was soon increased to 650 beds, and continued with this number until July, 1917, when the old American Ambulance was taken over by the United States government. Since then it has grown steadily to its present capacity of 2,000 beds. Even after it was militarized the vast majority of the patients were French, American wounded being in the minority. But this gradually changed until the ratio was reversed.

During the greater part of its existence the institution has been a base hospital, but as a result of the shifting of the Front it has at times served as an evacuation hospital. The neurologic work during these two phases of the hospital's existence essentially differed, as will be explained later. The work of the following neurologists contributed to the data incorporated in this report: Major H. O. Feiss, Major George E. Price, Capt. H. Unterberg, Capt. L. Grimberg, Capt. E. M. Connely; Lieut. A. H. Williamson and Lieut. William B. Terhune. Most of the operative work was done by Col. James P. Hutchinson, the remainder by Capt. P. M. Keating and Capt. T. Mullen.

GENERAL PROCEDURE

The neurologic work was conducted as follows: The wounded, when evacuated directly from the Front, without previous surgical

intervention, were examined in the Receiving Ward by a member of the neurologic staff before being sent to the operating room. This examination was necessarily hurried and therefore incomplete. Only a few moments were required with each patient to determine the presence of a nerve lesion. Sensory involvement of the musculospiral, median and ulnar nerves was determined by touching three points, namely, the first dorsal interosseous space, the palmar surface of the last phalanx of the forefinger and the little finger. Touching the dorsum and sole of the foot gave the same information for the two branches of the sciatic nerve. A few movements, such as closing the hand, spreading the fingers, extending the wrist, flexing and extending the foot and toes, gave an approximate idea of the conductivity through the motor fibers of the principal nerves of the two extremities.

When a nerve injury was discovered, a large colored card, indicating the nature of injury, was attached to the patient's papers and accompanied him to the operating room. This practice received favorable comment from the surgeons, and resulted in a decided increase in the number of primary nerve sutures. Subsequently, all patients were systematically examined in the wards by a neurologist, and a typewritten report of the neurologic findings included with their papers. A note was also made on the patient's Field Medical Card. It was the duty of the neurologic staff to make repeated examinations on these patients and to recommend nerve operations when indicated.

During the operation a neurologist was present, at times acting as assistant. He tested the exposed nerve for faradic excitability, gave his advice when requested, and afterwards made notes on the findings and surgical procedure. Following operation the patients were re-examined at intervals and notes of their condition made.

The French patients, owing to an admirable system of auxiliary convalescent hospitals, were retained until ready for nerve suture, following which operation they were kept under observation during convalescence. On leaving the hospital they were requested to report at intervals for examination. When they failed to do so detailed questionnaires were sent them, with the request that they take the questionnaires to the nearest military surgeon, or, none being available, to answer the questions themselves. On many of these individuals operations were performed over two years ago, so the opportunity for determining end-results has been excellent.

Previous to nerve suture, preliminary treatment was inaugurated. This consisted chiefly in massage and passive movements, proper apparatus being used to prevent overstretching of paralyzed muscles.

In the majority of cases secondary closure of the wound, followed by excision of the scar, preceded operation on the nerve, and was considered an important preliminary surgical procedure. After suturing the nerve, massage, electricity and passive movements were instituted as early as possible. To have patients engage in a suitable form of work is an important factor in the after-treatment, as many of them have related the first evidence of returning function in a sutured nerve to the volitional effort to use the affected extremity.

THE EXAMINATION AND RECORDING OF CASES

With the beginning of the year 1916, a definite routine of examination was introduced with the object of giving records the accuracy and clearness necessary to make them reliable. After many modifications a satisfactory plan was finally evolved from which no important changes have been made for about two years. Following is the formula used:

PERIPHERAL NERVES

Name Age Number Rank Organization Location in Hospital
Home address.....

HISTORY

Diagnosis: From papers accompanying patient. (Including date of wound and nature of projectile.)

Treatment Previous to Admission: Operation.

Date of Admission:

Information from Patient: What happened when injured; posture of body at time of injury. History of spasmodic contracture, paralysis, sensory disturbance, hemorrhage. Progress of condition since injury: improved, no change or worse; pain, nature of.

EXAMINATION

Date..... Part examined.....

Wounds: Location, extent, condition. Caused by original projectile or due to operation.

Deformities: (Position of joints.)

Bones: Fracture, callous formation, loss of substance, stage of union, local deformity, shortening or lengthening.

Circulatory, Vasomotor and Trophic Changes:

Atrophy: By inspection and measurement of limbs of both sides, at standard levels, with joints in standard positions.

Sensation: Record in writing and by diagram.

Motions: Estimate range and power of movement in standard directions with and without resistance. Compare with normal.

Reflexes: Deep and periosteal. Upper limb: Radiostyloid and olecranon. Lower limb: Knee jerk and ankle jerk.

Excitability: Compare with normal side. Mechanical. Electrical (faradic and galvanic).

Diagnosis. Prognosis. Recommendations:

SUPPLEMENTARY NOTES

Operation: Date, procedure and findings. Electrical reaction.

Progress of Condition:

Date.....

Signature of Neurologist,

In presenting this formula the significance of certain terms used, as well as their relative importance, may be briefly explained. As regards the "History" the subheadings explain themselves, but it may be pointed out, as applying to this or any other kind of history, that a simple and straightforward method of obtaining "Information from patient" is first to have him tell his own story and then to elicit further data by asking leading questions, such as pertain more specifically to the kind of case which is being studied. The list of important manifestations given in the formula will help to suggest the questions required.

Coming to the "*Examination*" itself, too much stress can never be laid on the importance of mentioning the date of examination in every case and of stating what part is being studied, as the omission of either of these elementary points might render the rest of the record completely worthless. The first heading, "Wounds," derives its importance first from the accurate description of their location, as indicating the probable level of the nerve injury, and secondly, from noting the stage of healing, the complete closure of the external wound being a necessary condition for surgical intervention. The term "Deformity" refers to habitual position of a joint, owing to a lack of subjective control. The fixation may be of any degree. For purposes of record it is necessary to estimate the angle formed by the parts at the joint.

Under "Circulatory, Vasomotor and Trophic Changes," it is very important to study every manifestation of the effect of the nerve lesion on the circulation, including the temperature and the color of the part, the dryness or moisture of the skin, the speed of return blood-flow as seen with pressure on the thumb nail and whether there is a tendency to sloughs. It is important to bear in mind that between the circulation and nervous system there is a reciprocal influence brought to

bear through the vasomotor system, and where there is a nerve lesion this influence gives rise to a vicious circle by which the effects on the nerve endings and vessels seriously damages the nutrition of the muscles. This condition in turn exerts a retarding influence on the proclivity of nerve fibers to regenerate, due to the poor nutrition of the end-organs.

The heading "Atrophy" entails the study of the special regions affected as a result of the nerve lesion, as well as the atrophy due to disuse, and that resulting from the pressure of bandages and splints. Atrophy is determined by making comparative measurements of the limbs of the two sides, at standard levels.

"Sensibility": There is no limit to the amount of time and effort that may be consumed if every phase of this class of manifestations is to be exhausted. For practical purposes it is sufficient to investigate the two phases that are easiest both for the patient and examiner to interpret; namely, the sense of touch and pain. The condition found is best indicated in the record by a shaded diagram.

Tinel's sign, as evidence of nerve regeneration, was looked for in the course of the examination. The value of this sign is doubtful.

With regard to "Motions," it is important that this term should have a definite and unequivocal connotation, and it is suggested that it be used to pertain to the range and power of movement, with reference always, to given joints. Comparison with the normal is to be made, testing the motion of each joint in standard directions, both with and without resistance. Where it is feasible, the power of individual muscles and groups of muscles should be estimated. The study of "active" and "passive" motion is, as a rule, not required, as a knowledge of the "power" and "range" of a motion includes that of "active" and "passive" control and has a broader meaning.

"Excitability" is of two kinds, mechanical and electrical, the latter being tested with both the faradic and galvanic currents. In the case of mechanical excitability, a reflex hammer is used, and the response of the muscular mass tapped is noted, chiefly for sluggishness. In the use of the faradic current one looks for response in both nerve and muscle, noting whether it is strong or weak. The most important information ascertained by the use of the galvanic current is whether or not the response of the muscle tested is normal or delayed in time.

MATERIAL

There are available for statistical purposes 857 histories of peripheral nerve injuries, with the records of 205 reparative nerve operations, 151 of these having been followed during convalescence for at least six months after operation.

The relative frequency of different nerve lesions was as follows:

Cervical sympathetic	3	
Total sympathetic lesions.....	—	3
Optic nerve	1	
Oculomotor nerve	2	
Facial nerve	16	
Vagus nerve	1	
Spinal accessory nerve.....	2	
Hypoglossal nerve	1	
Total cranial nerve lesions.....	—	23
Brachial plexus, complete.....	5	
Brachial plexus, partial.....	51	
Brachial and cervical plexuses.....	2	
Brachial plexus and cervical sympathetic.....	2	
Total brachial plexus lesions.....	—	60
Circumflex	11	
Musculospiral	198	
Median	55	
Ulnar	150	
Musculocutaneous	1	
Two nerves involved, upper extremity.....	95	
Three nerves involved upper extremity.....	41	
Four nerves involved upper extremity.....	4	
Total nerve lesions of upper extremity.....	—	555
Lumbosacral plexus	1	
Sciatic	116	
Internal popliteal	19	
External popliteal	61	
Anterior crural	14	
External cutaneous	1	
Two nerves involved lower extremity.....	4	
Total nerve lesions of lower extremity.....	—	216
Total nerve lesions.....	—	857

These figures show that the musculospiral nerve is the most frequently injured, the ulnar nearly as often, the sciatic is next, and the external popliteal, which is fourth in the order of frequency, is involved more than twice as often as is the internal popliteal.

The two nerves of the upper extremity most frequently involved together were the median and ulnar, the musculospiral and ulnar being next. When three nerves were involved the median, ulnar and musculospiral combination was by far the most frequent. These findings agree with what would be expected when the anatomy of the upper extremity is considered.

Fractures are frequently associated with peripheral nerve injuries. This occurred in 73 per cent. of the musculospiral cases, 57 per cent. of the ulnar lesions, 48 per cent. of the median injuries, 37 per cent.

of the external popliteal involvements, 25 per cent. of the brachial plexus cases, 19 per cent. of the sciatic and 15 per cent. of the internal popliteal lesions. Wounds complicated by fracture are naturally more severe than those not so complicated. It is also true that when a fracture is present a longer interval elapses between the date of injury and nerve operation. The records of this hospital show no larger percentage of recoveries in patients without fractures than those with such a complication, other factors being equal.

RESULTS

Comparison of the published reports of the results from nerve suture reveals a marked discrepancy in the success attained by various operators. While differences in technic, operative skill, and the time of operation play no small part in the results following nerve repair, the inconsistency in the reports may in part be due to the difficulty in interpreting the changes occurring after operation. It is necessary that a simple and logical standard of interpretation be accepted. The classification employed by Gosset meets such requirements and has therefore been followed in compiling these statistics. Having eliminated all patients who were lost sight of, or who were operated on less than six months previously, the results following operations have been classified as unimproved, amelioration, marked amelioration, and recovery.

A case was considered ameliorated only when there was definite evidence of nerve regeneration as proved by return of sensation, of the ability to make certain movements, by the reappearance of faradic excitability or the disappearance of trophic lesions. Those classified as marked amelioration show almost a complete return of voluntary movement, yet not sufficiently improved to be considered as absolute recoveries. A case was interpreted as recovered only when all voluntary movements had returned; that is, insofar as range of motion was concerned, although strength might not as yet have completely returned. Every effort has been made to eliminate movements effected by the uninvolved muscles. This has been done by adopting the criteria suggested by Pitrie, Claude, Froment and Gosset. It should be emphasized that if any error exists in the interpretation of the operative results of this hospital, it lies on the side of conservatism, for no doubtful results have been recorded. There is reason to believe that many cases now classified other than recoveries will as time passes show great improvement. Six months is too short an interval to judge results following nerve repair. Some such interval of time is necessary, however, as a working basis for a preliminary report.

The accompanying table is a summary of the results attained in this hospital following late operations on peripheral nerves.

OPERATIVE RESULTS

Diagnosis	Total Number of Cases	Recoveries	Marked Amelioration	Ameliora- tion	Unimproved
Musculospiral.....	44	6	11	12	15
Median.....	16	1	6	7	2
Ulnar.....	32	1	7	13	11
Median and ulnar.....	10	1	1	6	2
Median and musculospiral.....	1	—	—	1	—
Median and musculoctaneous..	1	—	1	—	—
Ulnar and musculospiral.....	1	—	—	—	1
Brachial plexus.....	1	—	—	—	1
Sciatic and branches.....	33	6	8	10	9
Fusions and anastomoses.....	12	—	—	1	11
Total.....	151	15	34	50	52

Excluding the nerve anastomoses and fusions, which in all cases were absolute failures, over 10 per cent. of the cases in which operation was performed resulted in recoveries; over 24 per cent. were markedly ameliorated, making a total of 35 per cent. greatly benefited. Thirty-five per cent. showed amelioration, this improvement having been sufficient in the majority of these cases to justify the operation. Twenty-nine per cent. are up to the present time failures.

With a limited number of operations it is difficult to say which nerves regenerate best. Certainly the musculospiral and the sciatic showed a higher percentage of recoveries; the results in the sciatic, although more delayed in appearance, were equally as good as in the musculospiral. Recoveries were rare following median and ulnar lesions, although marked ameliorations and ameliorations were frequent. It will be noticed that where two nerve lesions existed in the same wound very little success followed nerve suture, this in part being due to the greater destruction of tissue and interference with the blood supply in such wounds. It is the opinion of the neurologic department that nerve fusions and anastomoses are not, as a rule, justified. Such operations are successful in physiologic experiments on lower animals, but in late operations following injuries in war the procedure in our experience has not been of value.

In the operating room a nerve is often found tightly encased in scar tissue, the nerve itself showing indications of injury. The neurologist should decide whether simple liberation or excision and suture is the operation of choice. In reviewing these statistics it was found that 20 per cent. of the nerves liberated recovered, 23 per cent. were markedly ameliorated, 22 per cent. ameliorated, and 35 per cent. unimproved. Only 6 per cent. of the sutured nerves completely recovered, 24 per cent. showed marked amelioration, 40 per cent. amelioration, and 30 per cent. unimproved. The rule practiced here is, that

having utilized all recognized methods to determine which is the operation of choice, if doubt still exists it is best to excise the scar and suture the nerve.

In all discussions of nerve reparation there must be taken into account the interval of time elapsing between the date of injury and that of operation on the nerve. It is an established fact that the sooner the nerve is repaired after injury the better the result will be. This was well illustrated by the musculospiral cases; for the recoveries this interval averaged two and one-half months; for the marked ameliorations five months, for the ameliorations seven months, and for the unimproved eight months. The sciatic recoveries show an interval of two and one half months, the marked ameliorations and the ameliorations four months, and the unimproved five and one half months.

Owing to the fact that this institution has been a base hospital throughout most of its existence, primary suture of the injured nerve at the time of the first operation on the wound has not been possible in a large number of cases. However, for a short time this was an evacuation hospital and nerve sutures were performed at the time of the primary operation on the wound. These operations have been too recently performed to permit the compilation of reliable statistics. But one fact is most evident: the results of such operations have been extraordinarily good; far better than those following late operation. These results prove beyond any shadow of doubt that any surgeon who fails to repair an injured nerve at the time of the original operation, regardless of the condition of the wound, commits a very grave error of judgment. Even though in some cases the primary suture of the nerve may be a failure, it simplifies the operative technic in later operation, reduces the amount of scar tissue between the nerve ends, gives more nerve tissue for the future operation and insures a better blood and lymph supply for the nerve when it is finally restored to continuity. The opinion of the neurologic department of this hospital has not been based solely on their experience while the institution was an evacuation hospital, but also on the excellent results seen in patients whose nerves were repaired at the front and later were evacuated to this base.

REPORT OF CASES

A few case histories which may prove of interest have been picked from the records, some with the hope of emphasizing certain important points, others with the view of reporting conditions infrequently described.

The following is the report of the suture of a musculospiral nerve at the front two hours after the patient was wounded, and being one of several similar records, bears out the contention that when the nerve is repaired at the time the wound is debrided, recovery is often rapid.

CASE 1.—No. 10387. *History*.—Wounded Aug. 27, 1917, at Jouvenceaux by *eclat d'obus* (shell explosion). Admitted Sept. 11, 1917.

Diagnosis.—Wound in right arm. Paralysis of right musculospiral nerve.

Operation.—Suture of musculospiral nerve performed by a French physician at the front, two hours after patient was wounded.

Examination.—Right upper limb: A long linear operative scar in arm over the course of the musculospiral nerve.

Deformity: The hand tends to drop; otherwise negative.

Atrophy: Wasting marked on the extensor surface of the forearm.

Circulation: Hand cold, good radial pulse, part normal in color.

Motion: Shoulder: normal. Elbow: normal. Wrist: Patient is able to extend his hand well beyond the plane of the forearm to within 5 degrees of normal range; normal flexion; good ulnar flexion; no radial flexion. Fingers: Patient is still unable completely to close his fingers, but has very good flexion; normal extension; abduction is three quarters of normal. Thumb: Good flexion, poor extension: fair abduction, fair adduction.

Sensation: Hypoesthesia over distribution of radial nerve.

Excitability: No reaction in the musculospiral system to either current.

Diagnosis.—Old musculospiral palsy.

Conclusion.—With the exception of the extension of the thumb, this patient has recovered function. The case may be classified as one of great amelioration.

Note: Patient first noticed return of function a month ago (April, 1918). Further improvement might be expected.

Oct. 4, 1918.—The patient reports improvement in motor function beginning about last May (eight months after operation), manifesting the changes for the better little by little for some weeks and then ceasing to improve much, except for the power of extension, which he has developed in thumb joints.

Examination.—Sensibility: Slight improvement as regards intensity, area of hypoesthesia being about the same size it was at previous examination. Shows power in all muscles of musculospiral system, including those for thumb, which he can extend at all joints and abduct as a whole. These motions as well as other motions executed by musculospiral muscles still lack complete power (perhaps being now two thirds normal) and the range is limited a little actively (not passively). For practical purposes it may be classified as recovery.

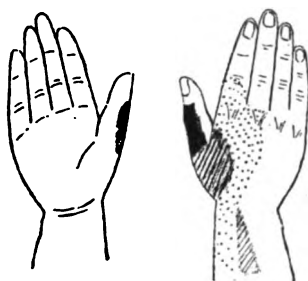
The next report is unique. One month after the musculospiral nerve had been cut and sutured there was definite evidence of return in protopathic sensation. The patient was an officer of distinction who had been carefully examined by numerous neurologists, both before and after operation, all of whom agree in regard to the sensory

improvement described. No similar case exists in the records of this hospital, although Purves Stewart claims that protopathic sensation may commence to return three weeks after secondary nerve suture.

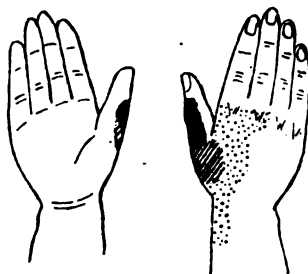
CASE 2.—Captain X. *History*.—Wounded March 11, 1918, by shell fragments, in left arm about middle third; compound, comminuted fracture of humerus.

Examination.—Left upper limb, July 4, 1918.

Deformity: Wrist-drop.



BEFORE OPERATION.



ONE MONTH AFTER OPERATION.




 ANAESTHESIA.
 MARKED HYPAESTHESIA.
 SLIGHT HYPAESTHESIA.

Diagram showing sensory changes in Case 2, Captain X.

Atrophy: Considerable wasting of the muscles on the extensor surface of the forearm.

Motion: Elbow: Strong flexion to right angle; strong extension to within 10 degrees of normal. Further movements in flexion and extension are limited mechanically. Pronation normal; supination can only bring the hand to the vertical position. Wrist: No extension; flexion one half of normal; limited mechanically; slight lateral movements; passive extension normal in range. Fingers: Can extend at interphalangeal joints but not at metacarpophalangeal joints; good flexion at interphalangeal joints, but only one half of normal range at metacarpophalangeal joints, being limited mechanically. Thumb: Good flexion, abduction, adduction and opposition; no extension except of terminal phalanx.

Sensation: Compare accompanying diagram.

Excitability: Faradic current: no response of muscles of musculospiral system in forearm. Galvanic current: muscles of musculospiral system react normally.

Operative Notes.—July 5, 1918. Incision made uncovering musculospiral nerve. Nerve found 2 inches above elbow and followed up into groove of humerus; about $3\frac{1}{2}$ inches above the elbow the nerve was found to be flattened, edematous and of a grayish color. The nerve was then followed to where it was caught in the bone. The upper end of the nerve was followed down to a point approximately opposite the lower portion to which it may have been joined by a very small band of fibrous tissue, the two ends were separated by scar tissue and callous half an inch thick. Both ends of the nerve were then cut until signs of nerve fibers were found. The nerve was sutured by five mattress sutures of fine silk. The operation required three hours and fifteen minutes.

Reexamination.—Aug. 6, 1918. No motion in extensors in forearm supplied by musculospiral nerve. Pinching the radial nerve or tapping over it in the upper part of the forearm caused an electrical sensation in the radial distribution over the thumb.

Conclusion.—The comparison of the two diagrams shows sensory improvement. This is a favorable sign and further improvement may be expected.

The following is a summary of the history of a case in which there was no apparent result for nearly two years after operation; then there was almost complete recovery:

CASE 3.—No. 41. Private P. J. was wounded in the right arm Oct. 16, 1915, by a bullet, which fractured the humerus and injured the musculospiral nerve. An operation was performed May 24, 1916. The nerve was found severed, both ends terminating in bone callous at the site of the fracture. The nerve ends were liberated, the injured portions of the nerve excised and the nerve sutured.

No return of function was noted until May, 1918. When last examined, Aug. 31, 1918, the patient was able to extend wrist and hand a few degrees beyond the plane of the forearm. He could extend fingers to the level of the hand. Could extend terminal and second phalanx of thumb. He could not abduct thumb. Sensation had entirely returned except for slight blunting over dorsal surface of thumb. The case was classified as marked amelioration.

The last case to be described is of interest because the operation was performed to relieve pain. This has not been necessary in many cases. In fact, exceedingly painful nerve lesions have not been as frequently encountered as the published reports might lead one to expect. When causalgia does exist, however, there is a reason for it, such conditions as pockets of pus or hematomas having been found to be the cause, as well as definite injury to the nerve.

CASE 4.—No. 8463. Private A. K. had been subject to two reamputations below the knee because of a "painful stump" following a primary amputation of the foot. A third reamputation above the knee had been advised because

of a continuation of the pain, associated with spasms of the muscles of the stump, which prevented his wearing an artificial leg.

A band of hyperesthesia was found on the stump corresponding to the cutaneous distribution of the sciatic nerve. Pressure over the sciatic nerve in the thigh caused severe pain and spasms of the muscles. Pressure over the anterior crural nerve gave no pain.

Further examination revealed two small scars, one on the outer and the other on the inner surface of the thigh, the result of a through and through wound caused by a machine gun bullet. The location of these scars showed that the bullet must have passed near the sciatic nerve.

The sciatic nerve was explored in the neighborhood of these scars and was found hard, thickened and encased in scar tissue. The nerve was liberated and a neuromatous mass involving two thirds of the diameter of the nerve was excised, the cut surfaces of the nerve were approximated and sutured.

Following operation pain and spasm disappeared and the man is now able to walk with the aid of an artificial leg, the operation having preserved a useful knee joint.

CONCLUSIONS

As the result of considerable experience with peripheral nerve work certain facts have been found worthy of emphasis, some of which have been noted by other observers.

1. The musculospiral is the nerve most frequently injured in war; the ulnar nerve is involved nearly as often.

2. Following operation the musculospiral and sciatic nerves make the best recoveries, the results in the case of the sciatic being equally as good as these of the musculospiral.

3. The condition of an injured nerve when examined by sight and touch at the time of operation, is invariably worse than the previous clinical findings would lead one to expect.

4. When at the time of operation, having utilized all the methods to determine whether simple liberation or excision and suture is the best procedure, if doubt still exists, excise and suture.

5. Repair of an injured nerve as early as possible should be the aim of every surgeon. For this reason in time of war neurologists should be stationed close to the Front, in order that the wounded may be examined for nerve lesions before going to the operating room. This, by increasing the number of primary nerve sutures, will unquestionably lead to a higher percentage of recoveries.

6. Patients convalescing from nerve reparation should be encouraged to use the extremity affected, for volitional effort plays a part in the return of function.

7. The more respect the surgeon shows nerve tissue when repairing an injury the better will be his results. The nerve should be stripped and handled as little as possible and the ends should be so approximated as to place in apposition corresponding fasciculi of the cut nerve.

AN UNUSUAL CASE OF VAGOTONIA

ALFRED C. REED, M.D.

SAN FRANCISCO

It is unnecessary at this time to review the conception of vagotonia and sympatheticotonia. It is only desired to place on record an extreme and, in many respects, unusual case of vagotonia, under observation at the Navy Base Hospital at Mare Island. An exact all-inclusive definition of vagotonia cannot be given, as no case embraces all of the features known to occur in this condition and innumerable borderline syndromes are seen which may reasonably be classed as of vagotonic origin, but which are more or less obscure and even contradictory. Some symptoms undoubtedly associated with the condition are difficult to explain, and it is more than likely that our conception of vagotonia will change materially with fuller knowledge of the physiology of the autonomic nervous system. The essential etiology of vagotonic syndromes is poorly understood at best and in the case here reported, was not elicited.

According to Eppinger and Hess, vagotonia is characterized by a hypersensibility to pilocarpin with a relative insusceptibility to sympathetic stimulation. Various clinical indications of heightened tonus of the vagus system are present. These may include a varying number from a long list of symptoms, such as gastrosplasm, or spasm of any part of the alimentary canal, bronchial asthma, eosinophilia, biliary colic of nervous origin, spastic constipation, hyperacidity, bradycardia, cold, moist hands and feet, small pupils, sinus arrhythmia, increased frequency of urination, etc. In the case here reported many characteristic symptoms were present to a marked degree. No case presents all of them and sometimes none are very distinct.

REPORT OF CASE

History.—C. B. J., an American sailor, was born Dec. 29, 1891. He was a native of Arkansas and has always lived in Arkansas, Oklahoma and Texas until enlistment in the Navy some four months ago. He has had pertussis, mumps, measles and varicella, no scarlatina or diphtheria. Until the age of 15 he lived in Arkansas and was subject constantly to malaria. Has had no malaria since the age of 17. His mother died of tuberculosis when the patient was 8 years old. His father, three sisters and one brother are living and well. The patient is 27 years old, married, has four healthy children, ranging in age from 10 months to 6 years. His wife has had no miscarriage. The patient never had pneumonia, typhoid, or articular rheumatism. Eight years ago he had "grippe" and again in the present epidemic. He has had much trouble with his tonsils, and excessive pyorrhea. He has lost two incisors.

Has no tendency to colds or bronchitis. Has no cough nor pain in chest. Height is 70 inches. Weight 170 pounds. Ruddy complexion. Enlisted July 17, 1918. He has never had symptoms of circulatory trouble, although he has fainted twice in his life, both times from a very hot bath. For the last ten years he has been very constipated but had no indigestion other than that associated with present illness. By occupation he is a farmer. He has been twice infected by the gonococcus, the last infection four years ago was cured with no sequelae. He had chancroid two years ago, three soft sores without bubo. For this he was given four arsphenamin injections with no effect on the sores which were finally cured with aristol. He has never had a rash or skin eruption except that associated with present illness.

Present Illness.—This began in the spring six years ago, as a swelling of the insteps, which was painless and lasted for two months and did not progress further. That fall he began to have five to six day periods of general swelling, apparently an anasarca, with a few normal days in between the periods. The length of the periods of swelling gradually increased to about six weeks each with intervals of about four weeks. After a time the swelling involved also the arms and eyes. This condition lasted for a year. The following spring he suffered from "dumb chills," loss of appetite and weight, and the condition was diagnosed as "grippe." With this he had considerable cough and nausea. He was in bed for a month and was given so much calomel that he has been constipated ever since. Following this acute illness the periods of swelling became worse and he would swell all over to such an extent as to gain as much as 21 pounds in a few days. This situation lasted nearly a year. In all, he had seven attacks of general edema at intervals for three years. These attacks were always accompanied by severe generalized giant urticaria which the patient described as "bull hives." Between attacks he would be entirely well. For the last two or three years the attacks have been milder and the free periods longer, sometimes as much as five months intervening between them. Sometimes his tonsils would swell greatly, but he has never had edema of the glottis and his voice never became husky. With the attacks he always has considerable digestive disturbance, which usually was relieved by milk diet and fruit, with enemas for the constipation which was worse at these times. With the indigestion he suffers from cramp-like pain especially across the upper abdomen.

The present acute attack came on without obvious warning. He was enlisted with perfect physical examination, his statement that he "sometimes swelled up" being ignored. The present attack began with shooting pains, not very severe, over the trunk. Hives were very troublesome and the wheals were very large and evanescent. He felt weak and dizzy, but with no stomach trouble at first. He became very short of breath and complained much of the itching of the skin and of generalized tingling. He had no cardiac palpitation, but felt as if his feet were constantly going to sleep. He says that in previous spells, as now, he has had much "rheumatic pain" of indefinite and changing distribution but never articular. The patient was sent to a base hospital from another station with the diagnosis of spleno-myelogenous leukemia. This was based chiefly on a leukocyte count of 30,000 with a large, hard spleen.

Examination.—He had no palpable glands in the axilla, neck, epitrochlear or inguinal regions. The heart was normal and normal in function; no murmur and no change after vigorous exercise. Lungs negative. The abdomen shows slight tenderness deep in the epigastrium and in the right iliac fossa on deep palpation. The spleen was easily felt but not below the costal margin even on

deep inspiration. Its consistency was rather hard. No other organs or masses were felt. Fluoroscopic examination of the chest showed the heart, lungs and great vessels to be normal. The blood pressure was 120/72 (Mercer); six hours later it was 110/70. There was definite generalized edema, which was more marked around the ankles and feet. The urine was entirely normal. The coagulation time of the blood was eight and one-half minutes, the same as two normal controls. Temperature, pulse and respiration were normal. He feels well now, except for itching.

Subsequent Examinations.—One week later: Temperature was 99.2 F. yesterday (compare blood count table). No evidences of malaria could be found on repeated examinations. The sputum showed on culture and smear a few pneumococci and a few eosinophils. The Wassermann test was negative twice. Coagulation time normal. Arneth index 42 (6 16 40 36 8). Eosinophils 37 per cent.

Two weeks later: He has been swelling more and the urine has become proportionately lessened in quantity. There were a few patches of itching wheals on the palms as well as a mild generalized urticaria. Repeated examinations of blood at all hours of day and night show no filaria. There were no ova or parasites in the stools on daily examinations, with and without a cathartic, and with the best concentration methods. The roentgenogram of the chest was entirely normal. The roentgenogram of the gastro-intestinal tract showed the lower border of stomach 1 inch below the umbilicus; it was regular in outline. The duodenum was normal; the stomach emptied in six hours. In short the gastro-intestinal tract was entirely normal. The quantity of urine today was 635 c.c.; specific gravity, 1.032; acid; no albumin or sugar; urea, 14.1 gm.; total nitrogen, 15.65 gm.; ammonia, 0.392 gm. Repeated routine examinations were entirely normal except for evidence of some concentration during the edema. The edema is diffuse and general. At times he has abdominal, colicky pains and occasionally a little diarrhea.

TABLE OF THE BLOOD FINDINGS DURING A CHARACTERISTIC ATTACK

Date	Hemo- globin	Red Blood Cells	Eosino- phils	Poly- mor- pho- nu- clears	Lym- pho- cytes	Trans- ition- als	Mono- nu- clears	White Blood Cells	Remarks
9/19/18	80	4,450,000	0	64	36	0	0	7,000	
9/20/18	90	4,700,000	0	70	29	1	0	7,000	
9/23/18	90	4,290,000	0	68	31	1	0	7,000	
9/24/18	..	..	33	37	25	0	5	8,000	Hives and pain
9/25/18	80	5,100,000	26	40	32	2	3	9,000	
9/27/18	..	..	21	51	27	0	1	7,000	Edema
10/ 1/18	..	..	33	40	24	0	3	7,600	
10/13/18	..	..	29	60	10	0	1	61,100	Full attack
10/14/18	90	4,710,000	49	39	12	0	0	52,300	
10/15/18	90	4,650,000	67	22	11	0	0	52,400	
10/16/18	90	4,500,000	76	19	4	1	0	60,500	Edema less
10/17/18	..	..	75	15	10	0	0	57,700	Edema less
10/18/18	..	..	70	13	15	0	1	37,400	
10/19/18	..	..	78	11	11	0	0	24,600	Attack about over
10/20/18	..	..	64	14	18	2	2	20,900	
10/21/18	..	..	55	23	20	1	1	17,000	
10/22/18	..	..	51	25	22	2	0	12,800	
10/23/18	..	..	52	28	18	0	2	9,100	
10/24/18	..	..	49	24	26	0	1	8,100	
10/25/18	..	..	33	26	33	2	2	10,300	Four mast cells
10/27/18	..	..	35	25	37	0	1	7,000	Two mast cells

From the abnormal condition as shown in the accompanying table the differential count would gradually return to normal.

Two months later: The previous attack had entirely disappeared in the course of a month. He is beginning to have another milder attack of the same nature. The skin reactions to sixty-five proteins, and an assorted group of keratinoids, including horse dander, chicken and goose feathers, dog hair, horse hair, and also horse serum, are entirely negative. A portion of muscle was excised from the tendinous extremity of the deltoid insertion but showed no trichina. The teeth were put in good order. The tonsils gave no indication for removal. Adrenalin, 0.001 gm., gave no local reaction or general reaction except a rise of blood pressure of some 6 mm. Gastric analysis after a test meal, during height of attack, gave a moderate hyperacidity.

DIAGNOSIS

The diagnosis of leukemia made on admission was rejected because of the total absence of data supporting it. The large spleen seemed evidently due to the old malaria and did not increase in the three months the patient was under observation. There was no gland enlargement. The diagnosis of vagotonia rested on the presence of the various characteristic symptoms already detailed as well as on the absence of any other discoverable cause for the condition, especially the eosinophilia. It is to be regretted that the sudden onset of the influenza epidemic made it impossible to study the metabolism and drug reactions of this case further.

350 Post Street.

CONTRACTURE OCCURRING IN PARTIAL RECOVERY FROM PARALYSIS OF THE FACIAL NERVE AND OTHER NERVES *

WILLIAM G. SPILLER, M.D.

Professor of Neurology in the University of Pennsylvania

PHILADELPHIA

The occurrence of contracture in incomplete recovery from facial paralysis is well known, but so far as the writer is aware a satisfactory explanation of this contracture has not been offered. Gowers states that the cause of the late over-action and spasm is probably a change in the functional state of the cells of the nucleus of the nerve, produced by their altered functional condition during the complete paralysis—but, once established, permanent. Oppenheim likewise attributes the late manifestations of facial paralysis to irritation of the facial nucleus.

The most satisfactory explanation of the late facial spasmodic tic and of the late associated movements in the facial supply on the paralyzed side is to be found, in the opinion of the writer, in the abnormal condition which occurs in regeneration of the facial nerve. Such phenomena are never seen when the paralysis remains complete nor when recovery is complete; they develop only with partial recovery of the muscles of the facial nerve supply. The tic movement about the mouth, as the writer has frequently determined, is always synchronous with the winking of the eyelid, and is clearly an associated movement. When regeneration occurs and young axis cylinders grow out from the central trunk, some of these intended for the upper branch lose their way and grow into the lower branch, while others intended for the lower branch find their way into the upper branch; thus the cells of the facial nucleus originally intended for the innervation of only one branch of the nerve are brought into control of both branches, and no movement occurs alone in one branch. The person in such a condition draws up the corner of the mouth every time he closes the eye, or he partially closes the eye on the same side every time he draws up the corner of the mouth, so that the facial tic in the muscles about the mouth is nothing more than an associated movement. The writer does not claim originality for this part of the explanation, but so far as he is aware no one has explained satisfactorily the permanent muscular contracture. To him it seems reason-

* Read before the Philadelphia Neurological Society, November, 1918.

able to seek the cause of this contracture in overstimulation of the affected muscles. Every time the eyelids are closed the corner of the mouth on the affected side is drawn up, and the muscles of this part receive a stimulation to this extent greater than occurs in a normal person. Likewise, every time the mouth is moved, as in chewing and speaking, the muscles innervated by the upper branch are stimulated and the lids on the affected side are partially closed, thus the orbicularis palpebrarum is stimulated frequently in addition to that caused by normal winking. The muscles on the affected side, as a result of this excessive stimulation, are kept in a state of hypertonicity, and complete relaxation is not obtained, or is obtained for much shorter periods than in normal persons; the affected muscles kept in a more contracted state gradually shorten and in this way the late contracture is produced.

In cases in which the paralysis has developed very early in life and the regeneration has been more nearly confined to the normal distribution of nerve fibers, so that the regeneration of fibers of one branch has not led to a wandering out of fibers into abnormal pathways, except to a very limited extent, associated movements and tic movements may not occur except in a very limited degree. The writer has recently observed a partial recovery in a child of about 10 years of age in whom the facial paralysis developed at the age of 1 year and 3 months. Here there was no contracture, and apparently, at first sight, no associated movement, but more careful observation showed that forcible closure of the eyelids produced fine fibrillary tremors about the mouth on the affected side, such as occur in muscles whose nerve cells in the central nervous system are undergoing rapid degeneration. The fibrillary tremors were a form of associated movement, and occurred because very few fibers destined for the upper branch of the facial nerve had wandered into the lower branch during the regeneration, and the stimulation occurred in only a few muscle fibers of the lower supply.

This explanation, depending on the presence of aberrant nerve fibers in a nerve undergoing regeneration, may be employed also for the contracture which results in various parts of the body after an injury with partial regeneration of the nerve supply of the muscles in which the contracture occurs.

It probably will be found that such contracture occurs with partial recovery of motor power following a nerve lesion rather than with persistent complete paralysis or almost complete recovery. Where every muscle in a nerve distribution is stimulated on attempted innervation of a few muscles of the same distribution, as for example, the contraction of almost the entire muscular supply of the ulnar or

median nerve which may occur from attempted isolated movement of a finger in incomplete recovery of the nerve, the result would be overstimulation of the entire group of muscles.

There are other causes of contracture, among which faulty position plays an important rôle.

If this explanation of overstimulation of muscles for certain forms of contracture is accepted, caution against producing contracture by electrical stimulation as is given especially in paralysis of the facial nerve, has no justification.

CEREBELLO-BULBAR POLIOENCEPHALITIS ORIGINATING DURING OR AFTER EPIDEMICS OF INFLUENZA AND OF POLIOMYELITIS

INCLUDING THE RECORD OF A CASE OF EPIDEMIC ENCEPHALITIS OF THE LETHARGIC TYPE *

CHARLES K. MILLS, M.D., LL.D.

Neurologist to the Philadelphia General Hospital and Emeritus Professor of Neurology in the University of Pennsylvania

AND

GEORGE WILSON, M.D.

Assistant Neurologist to the Philadelphia General Hospital and Instructor in Neurology in the University of Pennsylvania

PHILADELPHIA

Three of the six cases recorded in this paper occurred during or after the recent prevalence of influenza, the history of an influenzal attack appearing to precede the occurrence of the involvement of the nervous system. The other three cases were observed at times when epidemic poliomyelitis prevailed. Five of the cases were clearly instances of focal encephalitis. The fifth case was doubtfully one of cerebello-bulbar encephalitis. In several of these cases the differential diagnosis most considered was that of cerebello-pontile tumor and localized encephalitis. A close scrutiny of the general symptoms of the cases, however, indicates that these were rather of an infection or toxi-infection than of a progressively increasing neoplasm. The latter was presumed in several of the cases, for a time at least, because it was held that the symptoms gradually augmented. Strictly speaking, this was not true, although the symptom picture was not completed as quickly as is usual in poliomyelitis or polioencephalitis. The sixth case was demonstrated pathologically to be one of epidemic encephalitis and progressed from the onset until death in about ten days. In the other five cases the course of the affection in its acute stage, however, corresponded to what we have not infrequently seen, namely, a rapid development of a part of the syndrome with a subsequent history of extension and recrudescence.

* Read before the meeting of the Philadelphia Neurological Society, March 28, 1919.

The body of these cases suggests, among other things, the relation-ship of ascending poliomyelitis and epidemic encephalitis, especially as regards the involvement of the ventral nervous system in the later stages. The literature which discusses the epidemiology and pathology of poliomyelitis is very extensive, and will not be considered in this contribution except to refer briefly to the special types of poliomyelitis or focal encephalitis illustrated by the cases described.

Batten has constructed an elaborate paper, brief references to which will be sufficient to cover most of the points we desire to bring out. A full bibliography of the subject is appended to his paper. Discussing the buller and profile forms of the disease, Batten refers to Bremer's report that 12 per cent. of 49 cases showed evidences of encephalitis, including the olivary, pons or mid-brain. Facial paralysis was the commonest manifestation, while cases with ataxia, nystagmus and tremor formed the next most numerous group. Besides the facial nerve nuclei, those supplying the tongue, the palate, the masseter and temporal muscles were sometimes affected, either unilaterally or bilaterally. Lesions of the oculo-motor nuclei occurred, giving rise to a complete or partial ophthalmoplegia. Blindness was sometimes associated with the ocular paralysis. The observations of Batten and the others whom he cites on the blindness sometimes seen in poliomyelitis, and the rhythmic tremor associated with ocular and other cranial nerve palsies which occur in mid-brain lesions, are of much interest, but are not within the scope of the present contribution.

Cases are referred to by Batten in which ocular palsies with nystagmus were present and still others in which there was evidence of involvement of the fifth, sixth and seventh cranial nerves, the variation in symptoms depending on the situation and extent of the lesion.

Describing the cerebellar or ataxic form of poliomyelitis, Batten states that this type is characterized by the acute onset of ataxia, sometimes associated with ocular and other cranial nerve paralyses and alteration of articulation. Nystagmus was often absent. In some cases the cerebellar ataxia cleared up quite rapidly, and in others it took many months or years.

Batten and Wickman recognize the "neuritic" form of poliomyelitis to which we make reference because in one of the cases of the following series both cerebellar and neuritic symptoms were present.

1. Batten, F. E.: Acute Poliomyelitis, Brain, Lond., Parts 1 and 2, 39: (June) 1916.

Batten refers to the occurrence of both second attacks of poliomyelitis and of relapsing cases. Our experience is that relapsing, or what is a better term, recrudescence forms of the disease not infrequently occur, as illustrated by cases in the following series. The patient after a first attack, which may be of moderate severity, has a decided increase or renewal of fever which results in marked cerebellar or cerebellar and paralytic phenomena. Besides these recrudescence or relapsing forms of cerebellar and other types of poliomyelitis, cases occur which from the first take on a course different from that usually described in the typical instances of the disease. They assume a sub-acute or sub-chronic character, the probable nature of the lesions not being fully exhibited for some weeks.

CASE 1.—Child 3 years old; influenzal attack followed by weakness and awkwardness in the use of the lower extremities; recrudescence of acute symptoms after three months; marked cerebellar asynergy affecting both lower and upper limbs; alternating strabismus and nystagmoid movements; no papilloedema; gradual improvement.

History.—This patient was a girl aged 3 years, who was brought from Vickburg, Miss., in the latter part of February of the present year. Last October she had an attack believed to be influenza, with high temperature, the acute symptoms lasting one to two weeks. The child had a tendency to be unsteady on her feet after she recovered from the febrile attack, getting gradually worse. About January 20, the patient began to have severe vomiting, after she had overloaded her stomach with apples and other food. She continued to be worried by her stomach for about ten days and about twelve days after the spell of vomiting, began to have great difficulty in standing and walking, stumbling and falling. In a week or less she was unable to stand or even to sit up straight. During the week before she was first seen by us the mother thought she had improved somewhat in her power of sitting up.

Examination.—This showed inability to stand alone, unless it was for a scarcely perceptible fraction of a minute. When she walked with assistance she kept the legs rather wide apart and was unable to gauge her position or stand with firmness. She had a little more control over the left than the right side. When she attempted to feed herself with a spoon she had difficulty in doing so, because she was awkward and did not reach her mouth accurately.

Symptoms.—Briefly stated, the patient's most important symptoms were a cerebellar station and gait, with also some marked cerebellar asynergy in the upper extremities—more pronounced in the right than in the left. She had also some involvement of her ocular movements of the nature of an alternating strabismus with nystagmus or pseudo-nystagmus, although this seemed to be rapidly disappearing. Dr. J. W. Croskey, the ophthalmologist who examined her, reported that she had no papilloedema.

Clinical Course and Outcome.—This patient remained under observation about ten days or two weeks, improving slowly but steadily in the use of her limbs and trunk.

The examination showed none of the general symptoms of brain tumor. The history indicated a febrile attack of some severity, leaving the child weak and awkward in her movements and a subsequent seizure with vomiting, after which the complete inability to stand and walk resulted. If the sickness in October was influenza with some poliomyelitis of the focal encephalitic type, a relapse or recrudescence of the febrile affection probably occurred three months later.

CASE 2.—*Man about 30 years of age; influenza with temperature from 100 to 102 F.; headache, vomiting, vertigo and diplopia; cerebellar station and gait; paralysis of right external rectus and of right facial nerve; nystagmus on horizontal excursion of eyes to right or left; no papilloedema; rapid improvement with recovery in about one month.*

History.—This patient was a physician, aged about 30, who recently had been living and practicing in West Virginia.

The patient stated that he had stopped work two weeks before he came under observation. For several days before that time he had not been feeling well. His temperature had been running from 100 to 101 F. He went to bed with a temperature of about 102, headache, and hyperesthesia over the left chest and right side of the face. He also suffered from dizziness and vomiting in the morning. He had some diplopia on looking to the left. His headache continued.

Examination.—Dr. W. T. Zentmayer reported that the patient had paralysis of the right external rectus and partial paralysis of the right side of the face. The fields of vision were normal. The patient was myopic, but had no papilloedema. Some nystagmus was developed in looking either to the right or left.

Our examinations confirmed the paralysis of the right external rectus and paresis of the right facial nerve. No motor fifth paralysis and no impairment of hearing were present. Nystagmus was developed in looking either to the right or left. He had a Romberg symptom with eyes closed and showed decided unsteadiness in walking. No hypermetry, or adiadokinesis, or tremor was present. Knee jerks were very prompt, but a Babinski response was absent. He had no clearly determined objective loss of sensation, although at times he thought he felt a little better on the left than on the right side of the face.

Clinical Course and Outcome.—This patient went to Atlantic City where he remained for two weeks. In a day or two the paralysis of the right external rectus began to improve and in a few days had entirely disappeared. At the same time that the abducens paralysis improved, the loss of power in the seventh nerve distribution began to grow worse and in a few days was so marked that the patient exhibited almost a complete paralysis of the upper and lower branches of the facial nerve. In about a week this paralysis also began to clear up and when he was seen at the end of two weeks from the time when he was first examined, both the sixth and seventh nerves were practically normal. He still had a few nystagmoid movements in looking either to the extreme right or to the extreme left. Testing him for station and gait he was now practically normal, although he thought he had a little tendency to trend to the right in walking.

The history and examination of this patient indicated an influenzal attack with focal encephalitis, involving the cerebellum and bulb. Evidently, however, little destruction of nervous tissue took place, for the patient improved and in less than a month was almost normal.

CASE 3.—Severe febrile attack, either influenzal or poliomyelitic, in a girl of 11 years; headache; uncertainty in station and gait, probably cerebellar; pain in limbs, trunk and head; some weakness in abduction and dorsal flexion of feet with partial steppage gait; probable involvement in a poliomyelitic process of cerebellum and peripheral nerves; recovery in a few weeks.

History.—This patient was first seen by Dr. Mills, Jan. 17, 1912. She was then 11 years old. Four months previously she had a sharp attack of fever, supposed at the time to be typhoid, although this was doubtful. She had headache, chill and fever and at the end of about a week, when she was first seen by the family physician, her temperature was found to be 104 F. The high temperature lasted for two days and two nights. The attack was probably one of influenza or epidemic poliomyelitis. She was kept in bed for about a week. When she got on her feet she was found to be weak and uncertain in her station and gait. In a day or two she was able to walk fairly well, but from time to time had a return of the headache. About three weeks before she came under observation she became decidedly weak in the legs and had severe pain in the feet and legs, and occasionally shoots of pain in her trunk, arms and head.

Examination.—When first examined she had an uncertain station and peculiar gait. In walking she straddled, keeping the feet apart. She guided her steps by keeping her eyes on the floor. Examination for all the muscular groups of the lower extremities showed all movements preserved, but some weakness in abduction and dorsal flexion of the feet, these giving her what seemed to be a partial steppage gait. Her knee jerks were decidedly plus. She had a slight foot clonus on the right and no Babinski response on either side. Sensation was unimpaired and she had no nystagmus. She had no disorder of speech. Pupils were normal and she had no ocular, facial or upper limb palsies and no ataxia in the finger-to-nose test or the heel-to-knee test. The Wassermann test gave a very doubtful positive reaction.

The following opinion was given regarding this case:

"The history of the febrile attack looks more like a poliomyelitic (or influenzal) seizure than one of typhoid fever. The parents said the fever lasted only two or three days and the child was only in bed a week or a little more.

"The symptoms are peculiar and unusual. The child is somewhat ataxic and seems to have some weakness, but no paralysis, in the movements of abduction and dorsal flexion of the feet. The case may have been one of the extremely unusual instances of poliomyelitic cerebellar disease, that is, some inflammation and destruction of the cerebellum and other parts may have taken place. The pains in the limbs look toward a neuritis. On the whole, the prognosis is not altogether bad as the child may have reached the limit of her serious symptoms."

Clinical Course and Outcome.—This patient was seen for a few times for several months. She then passed entirely out of observation until February of this year, when she was brought for headache, mental depression and

irritability of the bladder. Examination for the old symptoms showed that they had entirely disappeared. Station and gait were normal. The Wassermann report was negative.

Final consideration of this case indicates that it was probably one of poliomyelitis, conjointly of the cerebellar and polyneuritic type, similar to cases referred to by Wickman and Batten.

CASE 4.—A woman about 30 years of age; numbness and some loss of power in the right half of the body developed suddenly, slowly increasing; six weeks after onset symptoms began to show marked exacerbation; examination showed on the left side paralysis of the seventh and sixth nerves, paresis in the motor fifth, and loss of hearing; vertical nystagmus and complete loss of lateral movements of the eyes; some loss of corneal sensibility on the left; sense of position and stereognostic perception lost; touch, pain, temperature and localization senses impaired on the right side; some ataxia in the finger-to-nose and heel-to-knee tests on the right; paresis in limbs of right side, with exaggerated knee jerk, foot clonus and Babinski reflex; perspiration localized in the right side of face and neck; gradual improvement in all symptoms, except the facial paralysis, the upper distribution of the seventh nerve being more markedly paralyzed than the lower.

History.—This patient was a single woman, aged about 30, who was admitted to the University Hospital on September 7, where she remained until Nov. 12, 1911. The case was one of much severity and of great interest as regards the question of diagnosis. Cerebello-bulbar tumor, meningitis and occlusion were suggested.

Until about July 4, a little more than two months before coming under observation, the patient had been quite well. One day she somewhat suddenly became faint and experienced numbness in the right side of the face and in the right arm and leg. She noticed also at the time some loss of power in the arm and leg affected. Gradually the power of the arm and leg became less. Until two weeks before coming for treatment, that is, about six weeks after the onset of her symptoms, she was able to get around without aid, although her vision was somewhat impaired. At this time, while on a shopping trip, her vision failed quite noticeably during the day. Her face was drawn up somewhat on the right side and her speech was affected. During the next ten days she grew gradually worse and three days before her admission into the hospital her symptoms rapidly increased.

Examination.—Neurological examination revealed the following: Complete left-sided peripheral facial paralysis, tongue going to the right on protrusion, and slight difficulty in swallowing water. Opening the mouth the jaw went to the left, showing motor fifth paresis. Movements of the masseters and temporals on the left were weak.

Sensation was normal in the fifth distribution on both sides, except for some loss of corneal sensibility on the left. The sense of position was lost in the right arm and leg, and touch, pain and temperature showed impairment in these limbs, this being somewhat more marked for touch. Marked astereognosis was present in the right hand. The sense of location tested for the right hand was much impaired. Active and passive movements were markedly diminished in the limbs on the right side, but not lost. Right grip was poor. Marked foot clonus was present on the right and the Babinski response was elicited with difficulty on the same side. The right side of the face and neck perspired profusely, the left remaining dry. Slight ataxia was shown in the finger-to-nose and heel-to-knee tests.

On several occasions from the time of this patient's admission to the University Hospital and as late as four years after this time the eyes were carefully examined and reported on by Dr. E. A. Shumway. The first report by Dr. Shumway made on the day of the patient's admission to the hospital, Sept. 7, 1911, was as follows:

"Spasmodic closing of right eyelids; left eyelids paretic, unable to close them. Pupils contracted; left, pin point size; right, about $1\frac{1}{2}$ mm. React to light. Vertical nystagmus, greatly increased in looking upward or downward. These movements are well carried out; complete absence of all lateral movements of eyes. Eye-grounds entirely normal; no blurring of nerve edges or disturbance of retinal circulation. Right vision, about 4/25; left vision, the same."

A week later Dr. Shumway reported: "Pupils still contracted; vision 4/20; apparently myopia from ciliary spasm. Eye-grounds show no changes. Refraction is low hyperopic astigmatism."

Other reports made by Dr. Shumway during the month after the patient was admitted to the hospital were as follows:

Sept. 25, 1911: "Returning movement of eyes toward right, especially of the right eye, which moves outward and downward. Left eye moves to the right, but much less well than right eye."

Sept. 26, 1911: "Right eye shows blurring of upper and lower edges of disk margin; no venous tortuosity. Left nerve slightly blurred similarly."

Oct. 6, 1911: "Nerves show no further blurring. Pupils less contracted. Movement of right eye toward right improved. No movement of eyes to left."

Examinations of her ears, nose and throat were made by Dr. Ralph Butler, who reported as follows:

"Pharynx examined for sensation showed practically no difference on either side of throat. In the larynx there is no paralysis either unilateral or bilateral, of vocal cords. Left drum head moderately retracted, especially the posterior half; mobility excessive, especially the posterior half. Tenderness along insertion of sterno-cleido-mastoid. Hearing for watch tick, air and bone conduction lost on the left; normal on the right. With tuning fork the patient recognized vibration on left, hears on right. Bárány's thermic nystagmus test—no result produced in the left ear (temperature 78 F.); maybe due to loss of lateral movement. Normally under this test both eyes should move to the right."

Clinical Course and Outcome.—It would be tedious and somewhat unprofitable to trace the history of this patient day by day or week by week from the time she was admitted to the University Hospital. An effort will therefore be made to summarize the results of observation and treatment. After the first few days gradual improvement began, this especially showing itself in returning power in the right extremities with concomitant improvement in the ataxia and sensory impairments. In a little less than two months the patient was able to stand and move around with difficulty. Her vision and loss of associated movements improved steadily. The facial paralysis persisted, as did also that of the sixth nerve. The seventh nerve paralysis was unusual in the fact that the upper distribution of the nerve was more pronouncedly affected than the lower, as shown by the loss of power in the frontalis and orbicularis palpebrarum. The lower distribution was also

paralyzed, but the patient in a comparatively short time had a return of the power to draw the face to the left and retract and elevate the corner of the mouth. The patient has continued under observation for years, being seen at comparatively long intervals—the last time, about a year ago. Eventually she recovered almost entirely, with the exception of the seventh nerve paralysis.

This case, in some respects one of the most interesting of the series, viewed in the light of observations extending over years, was clearly one of poliomyelitic destruction, cerebellar, bulbar and pontile. Like the case which follows, it for a time strongly suggested the diagnosis of tumor. Operation was at one time discussed and dismissed.

Several diagnoses were suggested in this case, these being tumor, meningitis, occlusion of the posterior inferior cerebellar artery, and encephalitis affecting the cerebellum, oblongata and pons. Tumor and meningitis were dismissed after consideration, the general symptoms of these diseases being absent. There was much in favor of the diagnosis of occlusion, especially corneal anesthesia on the left side and impairment of sensation, cutaneous and deep, in the opposite half of the body. The persistent destructive symptoms, however, were those which involved the motor cranial nerve nuclei and tracts and the left pyramidal system was evidently to some extent implicated. Sensory symptoms have been recorded in association with the motor nuclear and pyramidal signs in epidemic encephalitis, and even in spinal poliomyelitis. The course of the disease seemed to us rather to indicate an inflammatory process, at first of subchronic or subacute character, with later severe exacerbation. The sensory symptoms cleared up in a comparatively short time, while those referable to the motor cranial nerves, especially the seventh and sixth, persisted, the facial paralysis remaining permanently. On the whole, it seems to us that the diagnosis of a cerebello-bulbar encephalitis of the poliomyelitic type was most probable.

CASE 5.—A boy, five and a half years old; an attack of nausea and vomiting lasting several days; diplopia, weakness of the right side of the face, and awkward station and gait; paralysis of the right external rectus; no papilloedema; examination showed involvement of the fifth, sixth, seventh and eighth nerves; hypermetria, adiadokokinesis and tremor on the right side; deep reflexes exaggerated on the right; on the left, foot clonus and Babinski response; chief symptoms cerebello-bulbar on the right with some pyramidal symptoms on the left; no sensory manifestations; Bárány examinations were reported as indicating probable brain tumor; a first operation seemed to disclose a cerebello-pontile tumor; second operation made this doubtful; patient died, but no report on necropsy was obtained.

History.—The patient, a child, 5½ years old, was reported to have been very healthy until the age of 2 years when he had an attack of malaria, after which his appetite and general health were somewhat impaired. Six weeks before coming under observation he had an attack of nausea and vomiting which lasted several days. He may have had fever, but no record of this was received by us. After this attack he saw double. Some weakness of the right side of the face was noticeable and he stood and walked awkwardly. The patient was referred to Dr. Frazier and Dr. Mills by Dr. B. R. Tucker with the idea of having an operation should the case be decided to be one of neoplasm. Ophthalmic examination showed paralysis of the right external rectus and no papilloedema.

Examination.—The following is a summary of some of the results of the examinations of this patient:

In the first place, he had cranial nerve involvement—fifth, sixth, seventh, and eighth. Cerebellar symptoms were on the right side, hypermetria, adiadochokinesis and tremor. His deep reflexes were exaggerated. The knee jerks and Achilles jerks were present and active. On the opposite side, he had a true Babinski response and an abortive foot clonus. The examination, in brief, showed some probable involvement of the pyramidal tracts on the right, although the chief symptoms were cerebello-bulbar and pontile on this side. Sensory changes were entirely absent. The examination of the eyes of this patient by Dr. S. D. Risley showed no papilloedema, no pupillary abnormalities, and no ocular symptoms, except the paralysis of the external rectus. Bárány examinations were made by Dr. Isaac H. Jones, who reported his belief that these indicated a cerebello-pontile growth.

Clinical Course and Outcome.—With regard to the results of the examinations, these did not seem to be conclusive for brain tumor. Dr. Jones believed that there was a tumor of about an inch in length, reaching as high as the cerebral crura, but it seemed to us that a destructive lesion involving the nuclei and tracts of the nerves indicated by the symptoms might as readily explain the case. It was noticeable in this case also that the symptoms, with the exception of the involvement of hearing, were all motor and it seemed hardly probable that a cerebello-pontile tumor of the size apparently indicated would not cause some impairment of sensation, directly or by pressure. Such a tumor would almost certainly cause papilloedema and yet both fundi remained normal.

It was finally decided to operate. Dr. G. P. Müller performed two operations on the case. The first was a suboccipital craniectomy on the right side. The surgeon reported that there was probably a tumor of the right cerebello-pontile angle, over which certain of the nerves were stretched. It was considered at the time of this operation inadvisable to go further. About two weeks later a second operation was performed. The nerves were located, but now no tumor could be seen or felt. At the site of the pons and in the angle the brain had a grayish appearance as though an inflammatory reaction had occurred at this point. The surgeon felt that the boy had either some form of meningitis which had healed and left him with an exudate, or else that he had a tumor deep in the brain causing the symptoms.

This patient died a short time after returning to his home in Virginia, but we were not able to obtain any record of a necropsy. We regard the case as of much doubt from the standpoint of diagnosis. While there was much in favor of the diagnosis of a cerebello-pontile tumor, contradictory data were equally marked.

CASE 6.—Patient, female, 17 years old; illness began with diplopia, headache and vomiting; patient developed a stuporous or semi-conscious state from which she could be aroused by prodding; upper eyelids never elevated; catatonic state; some rigidity of the neck; horizontal nystagmus; left external rectus paretic; no papilloedema; all muscular movements slow and studied; deep reflexes absent or very weak; no Babinski reflexes; temperature ranged from 99.3 to 102.4 F.; urine and blood were normal; patient died on about the tenth day of illness; after hardening, naked eye examination showed softening and small hemorrhages in cross sections of the midbrain, around the aqueduct of Sylvius, and in the upper part of the pons; sections from the midbrain and the pons showed many minute hemorrhages and intense perivascular round-cell infiltration; sections from the oblongata and spinal cord at various levels, from the walls of the third ventricle, and the optic chiasm showed much less marked infiltration without hemorrhages; sections of the cerebellar and frontal cortex showed infiltration of the pia.

History.—A girl, aged 17, was admitted to the Philadelphia General Hospital on March 5, 1919, and died three days later. The patient was in the service of Dr. B. F. Stahl, to whom we are indebted for the privilege of reporting this case. She was unmarried, one of a large family, all of whom are healthy. There was no history of influenza during the recent prevalent epidemic. One week before admission into the hospital she complained of double vision while working and was told by her companions that her eyes were crossed. During this week the patient suffered from headaches and vomiting.

Examination.—When first seen the patient was in a semi-conscious condition. She could be aroused sufficiently to obey simple commands, but if not continually prodded would soon lapse into a state of semi-consciousness. The upper eyelids were never elevated, giving the patient an appearance of double ptosis. A catatonic state was present, the arms and hands after placing being maintained in grotesque attitudes for some minutes. There was a moderate, but definite, rigidity of the neck. Brudzinski's sign was not present and Kernig's sign was doubtfully positive.

Horizontal nystagmus was present and was fairly well marked. The pupils were widely dilated and reacted very little to light. It was impossible to make the patient converge. She had been attending an eye clinic and a mydriatic had been used. The left external rectus was paretic. The eye-grounds were healthy. As far as could be determined no other cranial nerves were affected.

After much insistence the patient could perform the finger-to-nose test in a lackadaisical manner, but without any ataxia or tremor. The extremities were not paralyzed, although all muscular movements were slow and studied. The deep reflexes could not be obtained in the upper extremities and in the lower extremities were very weak, almost to the point of abolition. Plantar stimulation gave plantar flexion of the toes.

The temperature, by axilla, ranged from 99.3 to 101 F., and a few hours before death it arose to 102.4. The pulse on admission was 90 to the minute, soon rising to 140 where it remained. The respirations were from 25 to 40 to the minute. There were one or two profuse sweats and at times a goodly amount of tears without other evidence of emotionalism.

The lungs and heart presented no abnormal condition. The urine was negative, as was also the serological reaction. Lumbar puncture was per-

formed without apparent discomfort to the patient, but unfortunately a bloody fluid was obtained, making a cell count impossible. The fluid did not contain any organisms.

Necropsy and Histologic Examination.—A necropsy was performed three hours after death. The heart muscle was flabby, but otherwise the abdominal and thoracic viscera showed nothing abnormal.

The brain and cord before section showed nothing on gross examination. They were placed in a solution of 10 per cent. formalin for ten days. Sections for histologic study were made under the supervision of Dr. W. G. Spiller in the Laboratory of Neuropathology of the University of Pennsylvania. These were from the midbrain, the pons, the oblongata, various levels of the cord, the walls of the third ventricle, the second, third, fourth and sixth cranial nerves, and from the frontal and cerebellar cortex.

On sectioning the midbrain and pons, areas of softening were visible to the naked eye in the region of the aqueduct of Sylvius.

The sections were stained by the Weigert, the hematoxylin and the thionin methods. The midbrain and pons in the neighborhood of the aqueduct showed intense perivascular round-cell infiltration and minute hemorrhages. This process was most marked around the aqueduct and decreased as the neuraxis was descended and ascended. It also faded out toward the periphery in the sections through the aqueduct. The oblongata and spinal cord at various levels showed decreasing perivascular infiltration without hemorrhages, except in the lumbar cord where one or two small hemorrhages were observed. Moderate pial infiltration was seen in the lumbar region. The walls of the third ventricle and the optic nerve at the chiasm showed the same perivascular round-cell infiltration. The third, fourth and sixth nerves showed nothing. Sections through the paracentral lobule exhibited rather marked round-cell infiltration involving both the cortex and the pia. The Betz cells were poorly stained, the nuclei were eccentric and the substance of the cell bodies was granular. In the frontal and cerebellar sections nothing was visible, except pial infiltration, the cortex appearing normal.

This case was clearly one of polioencephalitis similar to cases of epidemic encephalitis which have been described by Economo,² Netter,³ Kinnier Wilson,⁴ Bassoe⁵ and others.

The cases here recorded were probably of the same pathologic character, only differing in the location, severity and destructiveness of the lesions present. After all, the symptomatology of the fatal and nonfatal cases differs chiefly in the evidences of the extension and restriction of the lesions probably present. The existence of lethargy

2. Economo: Verein f. Psych. u. Neur. in Wien, April 17, 1917; Wien. klin. Wchnschr., May 10, 1917.

3. Netter: Soc. méd. des Hôpitaux de Paris, March 22, April 12-19-26, May 3, 1918; Bull. de l'Acad. de méd., May 7, 1918.

4. Wilson, Kinnier: Brain, Lond., 1906; Lancet, July 6, 1918.

5. Bassoe: J. A. M. A. 72: (April 5) 1919.

or stupor or semi-stupor in our sixth case, as in other cases, may have been conditioned, as has been suggested by several observers, by the intensity of the pathologic process in the region of the midbrain. In other words, the cases of encephalitis with lethargy have largely the symptomatology of polioencephalitis superior. Whether the etiologic factor in cases such as those here recorded is the same as that in epidemic poliomyelitis still remains to be determined.

THE WAR NEUROSES AS PHYSIOLOGIC CONSERVATIONS

SIDNEY I. SCHWAB, M.D.

Associate Professor of Clinical Neurology, Washington University Medical
School; formerly Major, M. C., U. S. Army; Medical
Director, Base Hospital 117, A. E. F.

ST. LOUIS

INTRODUCTION

This paper was written because it seemed an opportune time to set down in a permanent fashion the story of the effort made by the neuropsychiatric service of the A. E. F. to meet and combat the war neuroses. It has to do with matters of organization and the development of a point of view. It is largely with the latter that the author feels that he is properly concerned.

This story could not be told without frequent mention of Base Hospital 117 which was the special hospital for war neuroses at LaFauche. As medical director of this hospital from its beginning the author was given the privilege of seeing the various factors that went to make up this point of view develop. It is called in this paper the A. E. F. point of view. This is entirely an unofficial designation, and as a term has merely a connotative value.

In matters of clinical description, classification and mechanism, the responsibility is largely the author's, and although much that is contained in that part of the paper is a result of constant contact with an unusually intelligent, keen-minded and critically inclined staff, yet the conclusions arrived at are the author's own, and, as such, subject to whatever adverse criticism they merit.

The author is indebted to many men who have been concerned with the war neuroses and to many papers, books and monographs. Among the numerous sources in this literature the following deserve mention as being helpful: the various publications of Col. Charles Myers, Colonel Mott and Major Rivers of the B. E. F., and Yealland's book and McCurdy's monograph, and especially MacDougal's Social Psychology, a book full of wisdom, insight and inspiration.

I desire in this place to express my gratitude to the group of London neurologists whose talks on the war neuroses helped to clear up many a puzzling problem. To Henry Head, especially, much of what might be called the physiologic way of thinking is due.

The debt to Captains Thom and Hall, Lieutenants Durkin, Gale and Stout and to Captain McConnelly, the first group of men who made up the staff at Base Hospital 117, is too great to be adequately expressed.

Lastly to Col. Thomas Salmon, whose genius for organization, insight into the soldier's mind, and uncanny knowledge of things military made it possible to put into activity the organization to which his name will always be attached, the author makes due and grateful acknowledgement.

THE POINT OF VIEW DEVELOPED IN THE A. E. F.

One of the most significant attempts to deal with a medical problem associated with the carrying on of active warfare was the focusing of the neuropsychiatric department of the A. E. F. on the war neuroses. This was only a part of its work, but in the course of the unfolding of this scheme, there developed a point of view and a conception of the whole problem that may be said to be characteristic and, in a sense, typical of the American Expeditionary Forces.

It is the purpose of this paper to describe this attempt; to note the various parts of the machinery at work; to formulate the problem as it developed and to describe, as clearly as may be, the theories and notions as to origins, causes and mechanisms which came out of this attempt. An effort will also be made to translate this attempt into a working basis for the civilian type of neuroses so that whatever of truth came out of this experience may find an application to the same kind of problems, less dramatized perhaps, which have been so common in times of peace.

The war neuroses, as is well known, had presented both a medical and a military problem to each of the allied armies and probably to those of the central empires. Each army attempted to solve this problem, and, in working out a solution, more than purely medical factors had to be considered. Every medical problem in an army engaged in active warfare has many phases that are not met with in the same army at the stage of preliminary training, or under conditions that obtain at points removed from the zone of warfare. It is this multiplicity of factors which allows the development of individual and characteristic points of view and it is this which has given to the war neuroses an interest that is, in a measure, national. Given a set of factors which in their very nature tend to be complicated by distance from bases, transportation difficulties, hospital and divisional organization, and many others too numerous to mention, there is room for them to influence the plans of organization devised to meet the problem. Thus, on the one hand, the war neuroses stand out as a distinct medical entity, which in itself takes on no national peculiarities, and on the other hand, they appear as a military problem which is surrounded by sets of circumstances peculiar to one army alone.

The American Expeditionary Force was different from all the allied armies in that it was the only considerable body of troops so far removed from its base that transportation to home hospitals of

patients with war neuroses was absolutely out of the question. Therefore, these cases had to be treated or handled at or near the actual zone of fighting. At the very outset it was decided to keep such cases in France. On account of this decision the experience gained by the B. E. F. with the same type of cases was not applicable to our own problem. The fact that the American Army was fighting on foreign soil under foreign conditions to which it was difficult for so new an organization as ours to adapt itself, multiplied the difficulties of adjustment. In the French army it was an easy matter to organize special hospitals; to use for special purposes those already organized; to send the soldier back to his home for brief periods, and to take advantage of all the therapeutic means which proximity to home organizations permitted.

In the B. E. F. a somewhat similar condition existed, as return to England was simply a matter of Channel crossing, after which the whole of the medical resources of Great Britain was open to the soldier afflicted with this condition. Even if return to England was considered inadvisable, there were its hospitals and other institutions ready to take the overflow and to relieve the congestion which would be bound to occur if the number of cases should increase beyond the capacity of the hospitals in France.

A study of the methods used by these two countries in dealing with this problem shows that such physical influences had a more marked effect on their attitude to the war neuroses than any purely medical consideration. In the earlier years of the war the plan appeared to have had the definite purpose of getting these cases out of the way as quickly as possible. That there was a change in this policy is true enough, but even in the later months there were steady streams of such cases bound for back areas and toward home.

Whatever the advantages or disadvantages of this system may have been, and it is not the purpose here to criticize or comment on what was done in other armies than our own, the fact remains that the A. E. F. could not follow it. It could and did take advantage of the experience gained by other nations, but as experience only, and used it according to the conditions set for solving its own problems in its own way. From the beginning America was forced to develop a scheme of her own in dealing with the war neuroses and from this necessity, if for no other reason, arose what may be termed the attitude of the A. E. F. to the problems presented by the war neuroses. Certain physical factors controlled the formulation of this attitude, giving to it a certain positiveness and a certain definite directive power which were not found in the experience of other nations. As before alluded to, transportation difficulties forced the issue immedi-

ately, and made the central part of the scheme—that is, the attempt to solve the problem in France, or at any rate, away from home—of vital importance. When this decision is properly understood other factors on which this attitude was based follow as logical and necessary results.

If the war neuroses had to be handled in France there must be an adequate machinery. Therefore, an especially trained medical force was required. In this way the war neuroses became departmentalized and a special medical service grew up to care for them. This organization will be described later in this paper.

FACTORS LEADING TO THE A. E. F. CONCEPTION

An important medical element in making up the point of view of the A. E. F. was the notion of the war neuroses developed in the minds of the senior consultant in neuropsychiatry—Colonel Salmon—and some of the chiefs of departments under him. This was based primarily on a conception of the war neuroses as an aspect of primitive defense of the human organism against the traumatic incidents of warfare. The defense mechanism inserted itself automatically between the soldier and a repetition of the same or similar incidents which in the first place caused the soldier to react as a war neuroses case. As a result of this view formulated early enough to make it a part of the general scheme of treatment and organization, war neuroses were recognized as very real conditions, one to which any soldier given a succession of etiologic incidents, might fall a victim. In this way, also, the soldier could be viewed objectively and dispassionately in relation to his neurosis and the same method could be followed as is in vogue in the study of the many types of infections and other diseases to which a soldier in the performance of his duty is subject.

The question of the soldier's participation in the formation of his neurosis, how much conscious effort went into it, the rôle of exaggeration and malingering and other confusing incidents might then be made the object of legitimate inquiry uninfluenced by preconceived notions in respect to courage, bravery, wish, desire, cowardice, etc.

All of this created in the minds of the neurologists who had such cases under their care, a desire first of all to help the soldier, and then to fulfill his own military duty, which always centered about the effort to make of a sick or wounded soldier, as good a fighting man as was possible under the circumstances. The civilian notion in a similar case had to be forgotten and that of the military physician substituted.

These, in brief, represent the factors which went to make up what may be described as the A. E. F. point of view. To this may be added

the fact that from the chief surgeon of the A. E. F.—General Ireland — and his successor — Colonel McCaw — the department of neuropsychiatry and particularly the hospitals and field organizations that had to do with the war neuroses, received at all times the fullest support and encouragement. Perhaps, in this fact lies more of the uniqueness of the A. E. F. attitude than any of the foregoing statements. The American point of view, therefore, depended on the unique situation of the American Forces, which made it necessary to solve the question of the war neuroses in France; the recognition of the war neuroses as a disease entity; a realization of its mechanism of defense; a definite neurological organization to care for such cases, and above all, the cooperation and support of the chief surgeon of the expeditionary forces.

THE NEUROPSYCHIATRIC ORGANIZATION OF THE A. E. F. WITH REFERENCE TO THE WAR NEUROSES

The medical organization to take care of the war neuroses should be described because it forms what appears to be a distinct and definite contribution to the subject of war medicine. In any future war and, perhaps, under certain conditions in times of peace, similar organizations might prove effective. By this is meant that in all medical problems there is a certain aspect of war or of conflict and, to meet them effectively, an organization should have in it something of the elasticity, enthusiasm and coordination which the neuropsychiatric machine in France appeared to possess.

The organization passed through two stages, each of which warrants some comment. It was at first assumed that the war would be a long one, covering some years perhaps, and that the fighting for a time at any rate, would be either trench in type or more or less stabilized, so that the lines of battle would move very little either forward or backward. It was also assumed that the American troops would occupy a given sector of the Western front, and that the contingents would arrive there in groups of a given size. The American Army, it was supposed, would never be larger than about one million men. So it seemed an easy matter to calculate the percentage of war neuroses according to a fixed percentage taken from the experiences of our Allies and provide sufficient hospital facilities to take care of them.

The neuropsychiatric organization was briefly as follows: A special hospital for war neuroses was to be established within ambulance convoy from the lines, that is, within 20 miles or so from the front. From the divisions, through the division psychiatrist, would be sent to this base hospital by ambulance those cases presenting the more severe symptoms of the war neuroses. From this hospital those cured would

be sent forward to their own divisions; the others to various military duties in the S. O. S. A calculation based on the statistics in the B. E. F. appeared to show that in an army of about 300,000 men, a hospital of 300 beds would be ample, and with each succeeding contingent of this number of men, a similar base hospital could be established, the unit being kept standardized. Such hospitals were to be staffed by trained neurologists, and neurologically trained nurses and personnel. The treatment was to include all methods found useful in home hospitals, etc. In short, the plan contemplated a therapeutic effort in fair proximity to the front line similar to that in vogue in well equipped and staffed institutions under home conditions. The theory was that in the A. E. F. the soldier with war neurosis should be treated within the zone of active warfare just as he would be if he had been sent back to the United States.

In the earlier months of the activities of the A. E. F. this organization received its first test, and that it met that test was proof rather of its resiliency than of its entire fitness to meet conditions as they really developed. The idea that soldiers with war neuroses could be sent back to the base by ambulance from the divisions within forty-eight hours was found to be utterly impracticable. Two important conditions prevented this. One was that there was no American front in the previously accepted meaning of this term, the other that transportation could not be arranged for. What ambulances were available were needed for the wounded and for work in the front areas. During the months of June and July, when the series of engagements leading up to and including the Chateau Thierry fight took place, there were a large number of cases diagnosed as war neuroses. The percentage in some instances running as high as one out of five casualties. Although at that time the special hospital for war neuroses, known as Base Hospital 117, was in active service, only a relatively small number of these reached there as acute cases. Many hundreds were sent to far lying base hospitals — Bordeaux, Limoges, Paris, etc. — carried there by the hospital trains as part of the regular convoy of sick and wounded. Days and even weeks elapsed before such cases reached the special hospital which was planned, staffed and organized to care for them. Their stay at general hospitals accentuated, fixed and stereotyped their neuroses, because the first duty of a general hospital naturally was to the severely wounded and the severely sick. Consequently these cases did not receive, as a rule, expert neurological care. By far the greatest number of cases, then, which came to Base Hospital 117 were the severer and fixed types, although there were always a fair number of acute cases which came in rather by the chances of occasional transportation or from neighboring hospitals

within easy ambulance distance. This early experience and the fact that the fighting began to be open and the line advancing led to the readjustment of the scheme of organization to meet the changing conditions of the fighting on the Western front.

This showed plainly two things: (1) that with an advancing line of battle the war neuroses tended to escape proper treatment in the front areas, and (2) that in the difficult conditions of handling the sick and wounded many cases of exhaustion, temporary fear reactions and mild shock conditions were set down as instances of war neuroses. Many of these patients would recover promptly if given a short rest, especially if they came under the care of men who were neurologically minded, trained and interested. It became increasingly evident that forward screening was an essential element in the proper organization of the machinery to care adequately for those cases. Therefore, there were established forward neurological hospitals located on radii spreading out from Base 117. They were staffed largely from men who had been trained there and who were imbued with the ideals and spirit of that place and who could express in their contact with the soldiers—subjects of war neuroses—the attitude which had developed there and of which they had a part in developing.

These forward area hospitals were Army hospitals, three in number, of from 300 to 500 beds, located at first, roughly speaking, about 10 miles from the front lines. In front of them were the *triaux* connected with the field hospitals in charge of the division psychiatrists, some of whom had spent shorter or longer periods at Base 117, and all of whom showed the most active spirit of cooperation with the general plan of the organization behind them. The object of the *triaux*—that is, the forward screen—was to eliminate immediately, or within a few hours, such men as were mildly shocked, or merely frightened or exhausted who needed only the skillful assurance of the neurologist that they were but temporarily out of the game, and so were enabled to get hold of themselves and return to their fighting contingents. Those who were seriously affected were sent back immediately to the forward neurological stations, where they remained from a few days to two weeks or so, and from there were sent forward, while the very stubborn cases or those patients in whom the war neuroses had become more firmly established, or who presented symptoms more difficult to treat, were sent back to the base, which at that time, owing to the advance in the Allied lines, was anywhere from 60 to 90 miles back. To the base came also such patients as had escaped the screens and had been transported by trains to distant bases, or hospital centers and also such patients as had developed war neuroses enroute.

It can be easily understood that there was in this plan a degree of elasticity and resiliency that was capable of expansion or contraction to suit the changing conditions of actual warfare. As a further device, a mobile neurological hospital was contemplated which should serve the war neuroses in much the same way that the mobile surgical units served the wounded, so that no matter how rapidly the line advanced, a neurologically equipped organization would be in touch with it. The organization just described was that of the First Army. The Second Army was to be served in like manner, and if there had been a third in the actual zone of fighting, the same kind of organization would be developed. With the armistice, however, the organization of the First Army was the only one which had the test of actual experience.

Nothing so far has been said about the personnel, of which a great deal should be written and no doubt will be. It is worth mentioning, however, that it is the men who vitalize any organization, and if the plan just outlined did effective work, it was because the men in it were keen, enthusiastic and, as a whole, knew a great deal more about the war neuroses than would have seemed credible, when the brief time permitted for training was taken into account.

BASE HOSPITAL 117

As the focus of this scheme centered so largely about the special hospital for war neuroses at LaFauche, known as Base Hospital 117, some description of this place and what it tried to do, is essential for a thorough appreciation of the total scheme as has been outlined. The point of view of the A. E. F. was in a great measure crystallized there. The conception of the mechanism of the war neuroses which will be described later in this paper was largely a result of the studies and experience made there, and no better introduction to the description of the war neuroses from what may be designated as the clinical aspect, can be thought of than through a brief statement of this hospital, its plan, purpose, spirit and ideals. As medical director of this hospital from the beginning of its activities, the author had unusual opportunities to watch and study the growth, development and crystallization of ideas; those of the staff as well as his own with reference to the various problems of the war neuroses.

While much of what will be set down here may be regarded as in a sense the conception developed at Base Hospital 117, the author must be held entirely responsible for the expression of these views. It might be said that they represented a body of facts or theories filtered through his own mind in the various contacts between his staff and

himself, through numerous conferences, informal discussions, personal exchange of views, teaching and other activities.

Base Hospital 117 was located at LaFauche, a small village in the foothills of the Vosges Mountains on the main highway between Chaumont and Neufchateau. The hospital, at first a small camp hospital of 300 beds, rapidly grew to a capacity including tents of about 1,200. The location was an admirable one on account of the natural beauty of the place, its loneliness, and the fact that it was isolated from other hospitals or hospital groups. In spite of this, it was remarkably accessible—an important railroad going directly to the front areas through Toul; Nancy was within a half mile of the hospital, and paralleling this was the Route Nationale connecting many important towns, the names of which are intimately associated with the front held by the American troops. The hospital was an ordinary hut hospital with a chateau about a fourth of a mile away for an Officers' Ward and a convalescent camp across the meadows. It had about 90 acres of farm land which was later to be used as a part of the treatment of cases. This was the first American hospital for the treatment of war neuroses established in France, and it was part of the plan of Colonel Salmon that here was to be tried out and tested the methods of treatment and the problem of handling the war neuroses in the A. E. F. It was this semi-academic quality given to this hospital almost from the first, that led to the development of what seems to have been its unique feature. It early began to have a teaching atmosphere which later resolved itself into a kind of actual, informal school—a type of crude full time military university so to speak, which made it a delightful place to be in and an interesting place to visit. The staff—that is, the original staff of nine men—was made up of those selected in the United States, and by a group of four men who had received their training chiefly under Mott at the Fourth London General Hospital.

The staff of nurses was carefully selected, some training in psychiatric or neurological nursing being the necessary requirements. A department of civilian aids in charge of a therapeutic workshop, became a very valuable adjunct in completing treatment in functional paralyses and tremors. Such details are mentioned merely to bring out the general scope of this hospital and to emphasize again the fact that it aimed to reproduce somewhere near the active fighting and at a place close enough to the Army organizations in the field, as far as it was possible to do so, conditions of treatment not differing, in spirit at any rate, from institutions at home. Within reach of the atmosphere and discipline of an active fighting army the soldier with war neuroses was to be given treatment which was to embrace all methods which

were found useful. The only vital difference between such a hospital and one located at home was that in the former, the soldier was kept in touch with his military environment and, therefore, the necessity of being cured and returning to his place in the line was automatically emphasized from the moment of his admission to the time he left it. With the general scheme of the neuropsychiatric organization in France in mind—that is, as far as its relations to the war neuroses is concerned—a consideration of the war neuroses as a medical problem and apart from the scheme of organization for its care logically follows.

STATEMENT OF THE PROBLEM OF THE WAR NEUROSES

The war neuroses present three important aspects for consideration, each one of which necessitates some special notice. First, there is the military aspect of the problem. This concerns itself with the important fact that the soldier with war neuroses is, in most instances, physically intact and very often in splendid physical condition. His symptoms of disease are a disturbance due to an intricate psychical mechanism of defense^{*} based primarily on the primitive instinct of self-preservation. He obviously cannot be classified as mentally unfit, nor can he be regarded as physically disabled, yet he is incapable in this state of acting the part of a soldier. The fact that he has, at times, only a limited power of volition over his disability removes him from the class of malingerers, so the aspect of a man neither sick nor well presents a military problem of an unusual sort. As many of these patients have been good soldiers, judgment as to their potential ability for further military life must be suspended. Where to place him and what to do with him are questions that present themselves immediately. A soldier physically fit, mentally not affected, in every outward aspect a good fighting type, not a coward, often wanting to get back to the line, but held in the grip of a mechanism which negatives his soldierly impulses, presents a problem that has mystified again and again an officer who has at heart the best interests of the men under his command. Where the number of such cases increases to such an extent as to seriously threaten man power, then more than ever do the war neuroses assume the dignity of military importance. Therefore, no statement of the problem of the war neuroses can be made without considering from the very beginning its military significance. Many of the errors made in attempting to solve the problems of the war neuroses among soldiers might have been avoided if at all times the military point of view had been kept in mind. This point of view might be expressed as the effort toward returning such a patient to his former status as a soldier with the assumption that this is a perfectly possible thing to accomplish. The

second aspect is purely clinical. It may be very simply stated in this way: A traumatic incident or a series of them acting on the human organism, causes that organism to respond functionally by sets of abnormal reactions which becoming fixed, stereotyped and organized as symptoms gives the picture of disease called—in the A. E. F.—war neuroses, or shell shock according to the English designation. Obviously the thing to do is to classify these appearances into types, designate them in some way, differentiate them from similar types seen in other conditions, and devise some means by which they can be adequately treated and managed. The significant thing is that the war neuroses are essentially reactions to the varying incidents of war and that there is always present a known set of etiologic factors. There are, further, a fixed etiology, a varying effect from the etiologic incident, and a therapeutic aim, which has as its chief incentive the return of the subject of war neuroses back to the conditions which in the first instances caused them to appear. That, in brief, is a statement of the medical problem and the clinical point of view.

The third phase of the statement of the problem is that of mechanism. This implies that it is necessary to know something of the processes by which the clinical syndrome is activated and to regard the presenting symptoms more as an end and a result of some deeper lying, but not readily understood process. Something that must be first appreciated before anything really tangible can be done for the subjects of war neuroses. It is this emphasis on mechanism and not on clinical type, this apparent indifference to symptomatology which separates out the war neuroses from almost any other clinical problem.

The war neuroses, therefore, present these three chief aspects for consideration, an understanding of which makes the medical solution more easy of accomplishment. In addition, there are several incidental considerations which have forced themselves, often needlessly it might seem, into the problem, often hopelessly confusing it. Of no disease, with well recognized clinical expressions, has the question of the personal responsibility on the part of the victim come into court at all. If it does, it is easily dispensed with under the term malingering, but here there is brought up the question of cowardice, often disguised by another name, with the notion that in some way or other it can help in the solution by accentuating the personal weakness of the individual. This tendency leads to the theory that any soldier who develops war neuroses does so because he lacks courage, and does not have the moral elements which are essential to the make-up of a good soldier. The difficulty in such a point of view lies, not in the fact that an ethical label is put on a clinical syndrome, but solely in the fact that such a label serves no purpose whatever. It neither

cures the soldier, nor, what is of greater importance, can it return him to his work in the fighting lines. With an unlimited man-power, probably such a point of view would do no particular harm, as the proportion thus labelled and placed outside of military use would not be very large, but in a long war, such as this one threatened to be at the period of American participation, this kind of thing in two or three years would have become a serious handicap in keeping up the contingents of troops necessary for the purposes of offense and defense. The question was further complicated by the injection of the question as to the usefulness of a cured war neurosis case for front line work and the question of recurrence. Was the soldier permanently cured or not? The real question was rather—what are the chances in a given case of a soldier being exposed a second time to the same sequence of events as before? Clearly he might react in the same way and become for the second time a subject of war neuroses, experiencing in this way the identical thing that a soldier who receives a second wound after he has been cured of the first one and returned to duty as an active soldier. In many other ways too numerous to mention in this place, there was injected into the question confusing notions as to morale, personal responsibility, and considerable of what might be termed prejudiced and preformed objections to considering the war neuroses a strictly medical problem at all.

In fact, much of the difference of opinion had to do with elements entirely removed from any objective study of the condition. Strangely enough, many physicians in contact with these cases spent more time and energy in trying to decide whether the soldier, a victim of war neuroses, was worth bothering with at all than in attempting to appreciate what it was that had happened to him. A possible explanation of this curious attitude might perhaps be found by subjecting those physicians themselves who held such curious unmedical views to processes of analysis used in studying the war neurosis soldier. It was, in a sense, the evidence of an unconscious overactivated fear that they, themselves, under proper conditions might very well develop all the symptoms against which they showed so unsympathetic and uninformed an attitude. The proof of this statement may be found in the fact that men who have been through the actual experiences of front line work learn to view the victim of war neuroses with a new understanding and insight. It is this tendency of defense by the exaggeration of a normal repulsion to evident weakness in another that establishes what seems to be one of the most fundamental facts in the war neuroses themselves—that is, a defensive purpose as part of the great system of physiologic conservation. There is found in presumably normal men, in this instance physicians, evidence of a

mechanism of this kind, focussing on an anticipated set of experiences. The identical mechanism must necessarily be put into action when the experiences are no longer merely anticipated but real.

CONCEPTION OF THE WAR NEUROSES AS A DEFENSE MECHANISM

The conception of the war neuroses as a defensive mechanism or as a part of a system of physiologic conservation may be approached with less difficulty if it is made clear just what is implied by those terms. It is necessary also to appreciate the fact that the defense meant here is not conscious, but automatic and probably altogether outside of volition. There exists in all living organisms, sets of factors which work toward the saving of those organisms from destruction. There exists likewise in each important function of that organism, a mechanism for preventing function from becoming excessive and preventing injury to it as a whole or to its respective elements. Living would be impossible if this did not exist. The protection may be purely automatic and adjustable to mechanical factors, as for instance the hypertrophy of the heart; it may be chemical as in the immunity defense, or it may be various combinations and mixtures in which polyglandular activities come into play, it may be physiologic in respect to functional adjustments and psychical when deeper and more intricate activities of consciousness are at work. The latter may be termed physiologic, but for convenience it is better to consider it a definite psychogenic mechanism.

This principle of organic defense appears to be a very fundamental thing touching on the very innermost principles of living things. Naturally this principle has long been recognized and, by whatever term it has been designated, it has been an admitted fact to be considered always in the attempts to understand the phenomena of life. When the mechanism of defense, whatever its nature is, becomes inactive or less efficient, the living organism may be said to approach destruction, or if it fails completely the organism dies. It is possible, perhaps, to divide the defense mechanism into two classes, one acting to prevent the mechanical using up of living tissue—the wear and tear of the machinery of life as it were—the other to resist and modify the exogenous factors of a destructive kind to which every living thing is ceaselessly exposed. It is obvious that even if no sharp line of demarkation can be said to separate these two, yet the adjustability of the defense shows, in either instance, a difference in the quality of promptness and speed with which it can be put into action. The mechanically incited defensive organization is apt to be slow and cumbersome, taking place gradually according to the progress which the changed conditions of the mechanism itself necessitates, while the

other must be capable of meeting quickly and decisively the immediacy of an oncoming event. Therefore, the latter type of defense must possess a certain power of selectibility or adaptability because events or experiences are in their very nature dissimilar and varied. This seems to be true of the neuroses in general, and of the war neuroses in particular. If they are studied from some such point of view as this they show the characteristics of an exquisitely adjustable and often complicated piece of psychical machinery, adequately and, in a sense, personally fulfilling the purpose of protecting the individual against reexperiencing a series of destructive events to which he has been recently exposed. The analogy between the organically inspired defense mechanism and those physiologically activated or sensitized, as some one has described them, probably goes no further than this, and the comparison has served its purpose if the fact has been made clear that the neuroses defensively considered are a part of a mechanism so fundamental for the preservation of life, as a physical phenomenon, that their existence cannot well be doubted. There is nothing new in this conception. Freud long ago, and others before him, had seen in the neuroses something more than a collection of symptoms simulating organic diseases. Many students of the neuroses have been impressed with the apparent needless over-emphasis of symptoms in face of slight degrees of possible determining factors, and they must have seen in this, or dimly felt at any rate, that some other incentive was at work than merely processes of reaction on the part of the organism. It was in this zone of over-response that the explanation was to be found.

With the appearance of Freud's *Abwehr-Neurosen* in the early nineties, the conception of the neuroses as defense mechanisms began to make slow headway among the neurologists. To many of them the rest of the freudian psychology was not convincing. That conception however, was so helpful and clarifying that it gained the support and belief of many to whom anything else coming from that school would not have been acceptable.

The war neuroses have given the opportunity to test out this aspect of the freudian psychology by furnishing thousands of cases in which well known and a more or less constant etiology were always to be found, and in which the resulting reactions might be studied divorced completely from the cloud of etiologic sexual entanglements which so confuse the attempt to understand the peace neuroses.

If this short exposition of the defensive quality of the neuroses has been sufficiently convincing to create at least a sympathetic attitude toward it, the way is prepared for a closer consideration of two essential preliminaries before the neuroses can be clinically considered.

One of these has to do with an attempt to differentiate between the neuroses and the psychoses; the other, with the attempt to define the war neuroses as definitely and clearly cut as possible. Closely associated with these two attempts will be an effort to place in its proper position in the structural formation of the neuroses the rôle of primitive instincts.

DEFINITION OF WAR NEUROSES

One of the confusing aspects of the war neuroses in the first few months of the war was the tendency on the part of many physicians in both the French and British armies to regard the neuroses as mental diseases. Many patients were sent home or to backward areas with the diagnosis of depression, mania, dementia praecox, etc., and found their way eventually into institutions for the treatment of the insane. This is mentioned not in the way of criticism at all, but because it will make clear, perhaps, that this question was presented very early. There comes almost immediately into the mind of any one having to do with large numbers of soldiers with war neuroses the same question: Are these things psychoses or not? Clinically, they are often similar to well recognized and conventional types of psychoses. Unlike them, however, they show a surprising quality of getting rapidly and unexpectedly well. The question, then, is: What is meant by a neurosis and how does it differ from a psychosis? The only feasible way to determine this question is to place the differences between these two terms side by side, and to arrive at a definition of the neuroses by excluding from them qualities which seem fundamentally included in the psychoses. In this way it is possible to accurately define neuroses in terms of the excluded pertinent factors in the psychoses.

With the end in view, then, of an attempt to define the neuroses with the direct purpose of giving to the war neuroses a special place, the following is set down for consideration.

As a preliminary point the psychoses which are here touched on are the so-called inorganic types. None of these due to organic changes, or defects in the brain, or to the results of toxic or chemical processes, are considered. This is not an arbitrary distinction, but one made necessary by the assumption which has been so often emphasized, that the neuroses are defensive mechanisms, demanding always as their first requisites a consciousness that can act in a normal manner.

The difference, then, between the psychoses so limited and the neuroses lies largely in the notion that in the psychoses there is a want of a primary and logical purpose. A psychosis in the long run always acts to the disadvantage of the individual, both in relation to his

immediate environment and to society. Its origin, therefore, must lie in processes of consciousness which are permanently abnormal, destructive and constantly departing from a normally acting intelligence. Sooner or later a psychosis brings the individual in conflict with himself, his class and society.

The neuroses, on the other hand, never do this, nor can they do it. For as their origin and purpose are fundamentally protective, a conflict leads to the enfeeblement and eventual disappearance of the individual out of his environment. The neuroses are, therefore, protective mechanisms which tend to guard the individual from the immediate event for which he lacks proper personal adaption. The psychoses, on the other hand, serve no protective purpose whether immediate or remote, but on the contrary tend logically to the destruction of the individual in the conflict of events. They are permanent deviations, progressive in type, which arise without set purpose, and are the consequences of abnormal processes in consciousness. They tend to the elimination not the saving of the individual. In the struggle with society it is generally the individual who succumbs, either as a living organism or as a member of a social order. The neuroses, on the other hand, are the products of an intelligence awake to the needs of the individual and are structures of compromise between him and society. They tend to shield him and so do harm to society. They arise in consciousness from fully realizable premises, but tend to become automatic and without the individual's awareness, so that he reacts to them instead of the things that he is cognizant of in his own make up.

It is to be noticed that in this definition of the neuroses there is no attempt to fix on an etiology. The causative factor of events is touched on, but it is given no specific meaning. In the war neuroses, on the other hand, there is the qualifying factor of war, and this definition to have any value for the present purpose must hook up with the ever-present set of circumstances associated with military activity in war time. This brings with it an important element scarcely hitherto touched on in this paper, and that is the instinct of self-preservation and its activating source — the emotion of fear.

THE RÔLE OF INSTINCT

No attempt will be made here to define instinct. Two of the instincts may be called primary, primitive or fundamental. These two are the instinct of self-preservation and propagation. They represent certain necessary qualities of life without which life would be impossible. That is, it could not continue. To be continuous it is essential that the individual should live at least long enough to propagate, in

this way preserving the quality of continuity. Neither of these two qualities is possible without some mechanism tending in the long run to preserve life as existent, and to prolong it beyond its individual expression. These two instincts might be termed essential because they are necessary parts of the phenomenon of living.

In the other instincts, and their number is as great or as little as is preferred, it is found that they do not represent these innate and essential qualities, but do represent certain tendencies or impulses which depend rather on racial or species experiences. These are the things that have in the long run acquired a certain positive value in the struggle both to prolong the life of the individual and to render as easy as possible the passing on of life beyond the individual. Such tendencies are probably acquired and inheritable. By repetition from one series of individuals to another they become dominant. The nervous mechanism by which they are set in action becomes by each successive wave of individuals more adapted and prepared for the reception of the sensory excitant, the emotional background and the motor outlet. In some such way they tend to develop into complicated reflexes, each one of them conditioned by a particular set of circumstances.

In the war there is the essential instinct of self-preservation. This is the instinct primarily involved. Many of the others play their part, but are secondary and unessential. In the war neuroses the motive is furnished by the presence in a very active and, to the individual, unusual way of the instinct of self-preservation. The war neuroses may be looked at, then, as an elaboration of this instinct carried out as primary instincts always are without the individual's will or knowledge. They are defensive, automatic adaptations on this basis because the individual has no longer the power of adapting himself to immediate condition and he surrenders himself to a more powerful defense that he himself can possibly, consciously, construct.

THE CLINICAL PROBLEM

With this conception of the neuroses in mind there remains to study them as they show themselves clinically in varied disease pictures, and to attempt to understand what these pictures mean and how they came about. The test of the accuracy of this conception is to be found in the light that it can throw on origins and mechanisms and the use that can be made of it in appreciating why the thing has happened. A further test will be shown if the facility by which symptoms can be treated and the patient restored to the condition he was in before is increased. The war neuroses show themselves clinically in a variety of confusing types. Classification seems almost

impossible because the same symptoms are represented by types that are obviously distinct. In a group of a hundred acute cases, for example, there will be many symptomatic types, frank hysterias, anxiety groups, pure sensory disassociation forms, individual over-reactions, concussion forms, episodal and transient mental states, etc. Two ways are open in facing so complex a clinical demonstration. The first is to regard classification as of little consequence, but merely to find some few labels grossly descriptive of large groups and then to think of them as a whole and approach the therapeutic task by some mass form of treatment. The other way is to attempt a grouping, not based on clinical appearances alone, but on mechanism and the most immediate of the etiologic factors concerned. The former method has been adopted by most of the English and French neurologists. It has a certain advantage, chiefly in the avoidance of intimate study of individual types, and in supplying a ready means of avoiding difficult and controversial questions in regard to terminology. For example, it would be perfectly feasible to say that all war neuroses belong to one of two groups—neurasthenia or hysteria—implying that those showing primary fatigue elements belong to the former, those showing paralyses, sensory anomalies, convulsions, etc., to the latter. A third group might be made up of the concussion types. Some of the very best therapeutic results have been obtained by those to whom a further effort seemed useless. It should by no means be inferred because no effort is made to classify or carefully group cases, that the work is unworthy of praise. At one time in the English service, in the forward areas at any rate, all cases of shell shock were called hysteria, and the Babinski conception was thought to be applicable and satisfactory. In the French literature little attention is paid to the study of intimate mechanisms, yet no one can say that in the later years of the war either of these nations failed to take care of its quota of war neuroses adequately.

It seemed, however, in our own experience, that in the long run the more minutely the cases were studied the more effective the therapeutic methods would become. The first and essential step was to disintegrate the mass into groups. The smaller groups then make an intensive study of mechanisms easier, forming by comparison with other groups a standard of measurement. Furthermore, the various groups which sprang up almost automatically as a result of this tendency to analyze the material became, as it were, centers about which clustered specially developed therapeutic methods, prognostic experiences, disability classification questions and characteristic sets of mechanisms. All of this lent to their study a surprisingly increased amount of interest. A common differential diagnostic language grew

up, at first limited to the staff at Base 117, which later spread to the forward areas and became, in a measure at any rate, the means by which men could converse or write to one another about their cases.

Therefore, the attempt to classify the war neuroses or group them seems to be justified by the use which was made of the grouping and by the impulse it gave to a closer scrutiny of individual cases as they fitted themselves into this or that class. It must be understood that a grouping of this kind is only of value if it fulfils the test of utility. If it does not, it deserves to be given up without further argument. That it did seem to stand this test, at least in the experience of Base 117, is the reason that it will be described in this paper.

Before venturing to classify these cases, or rather label them when grouped, a preliminary thing had to be done. This was to redefine such terms as had been used before and to define the terms that were new. This implied in some instances a rather new, or at least a novel point of view, and a departure from some of the cherished landmarks of our old neurology. Two factors necessarily influenced all the conceptions in classification. One was that the war neuroses were essentially a war-born condition, and that etiologic incidents were all colored by this fact. The other was the conception of the defensive or protective character of the neuroses frequently referred to in this paper. A classification which implies a theory may seem artificial and dogmatic and applicable only to a limited series of differing conditions. This and other objections more vital might be advanced. For example, this classification is confusing because three things are considered in the grouping and given unequal prominence: etiologic traumatic incidents, symptomatic expression, and what may appear at first sight to be an arbitrary selection of psychological mechanisms.

It appears necessary to point out these defects for the reason that classifications are so often the objects of needless controversy and too much emphasis is often placed on them—an emphasis by no means justified in this instance when the modest origin of these attempts is considered. If this attempt at grouping, then, served the purpose of usefulness it might take its place as a pragmatic constituent of the work done at Base 117.

CLASSIFICATION

The following groups were recognized as diagnostic entities at Base 117:

- | | |
|---------------------------|--------------------------------------|
| 1. Neurasthenia. | 9. Timorousness or state of anxiety. |
| 2. Psychasthenia. | 10. Concussion: |
| 3. Hypochondriasis. | (a) Syndrome. |
| 4. Hysteria. | (b) Neurosis. |
| 5. Anxiety neurosis. | 11. Gas: |
| 6. Anticipation neurosis. | (a) Syndrome. |
| 7. Effort syndrome. | (b) Neurosis. |
| 8. Exhaustion. | 12. Malingering. |

The various incidents associated in the etiologic sequence of the war neuroses tend to separate themselves into three definite classes: (1) The individual himself from the point of view of his own nervous system; (2) factors which are preparatory of favoring — perhaps indirect would be a better term — and (3) the direct or energizing factor, the thing or things that render the soldier an immediate or potential victim of a war neurosis. In attempting to give due weight to these factors much controversial ground will have to be gone over and difference of opinion will be encountered every inch of the way. It is only fair to state that what is here set down is based on a sufficiently large material to afford numerous opportunities to test out and measure the accuracy of the conclusions arrived at. Considerably over 4,500 cases came under the observation of the author; some of these were intensely studied, some were observed as part of his duty as medical director, but all were seen one way or another.

NEUROPATHIC INHERITANCE

One of the most discussed questions and one to which too much emphasis has been given, has reference to the question of what has loosely been called neuropathic inheritance tendency or something equally uncertain. The reasoning ran something like this. No soldier who is not of a neuropathic type can develop war neurosis. The fact that he shows symptoms of this condition is an admitted proof that he belongs to this class. Thus having arrived at this conclusion all that remained was to find evidence supporting this contention from the patient's past history or the stock from which he came. In a very high percentage of cases sufficient data of this kind could be found. This was taken as proof of the contention.

By delimiting the things that could be fairly termed neuropathic and by studying the individual's personal and family history uninfluenced by his present condition, a different conclusion was reached. For example, a history of epilepsy in a cousin might be considered as an important neuropathic trait from the former point of view, while it would completely lose its significance in the latter. A series of soldiers not afflicted with war neuroses was studied from this point of view in the material in the B. E. F. Hospital to which the author was attached. Slightly under 2 per cent. might be classed as neuropathic, a similar series among patients with shell shock (this term is usual in the British service) showed something under 5 per cent. This discrepancy is easily accounted for by the tendency to scrutinize a bit more carefully the data in a war neurosis case than in any other. As the mass of material grew larger the proportion of neuropathic cases grew less and its percentage tended to decrease rather than to increase, but it never appeared to be much greater than 5 per cent., and never under about 2 per cent. Of course, this question cannot be

settled until the more exact methods used in the best eugenic studies are duplicated, and this was manifestly impossible under the conditions in France. Two facts seemed to come out of this attempt to give neuropathic inheritance its proper place in etiology. One was that, all things considered, the neuropathic soldier would react more quickly and more deeply to a set of traumatic incidents, and the other was that almost all uncured or incurable cases—the so-called D. classes of the disability board—were evident neuropaths, either coming from a stock touched with insanity, epilepsy, alcohol, etc., or showing in their personal history evidence of such influences. Whatever the final conclusion of the direct rôle of neuropathic inheritance may turn out to be in the cases of soldiers beyond the 2 to 5 per cent. mentioned, the frequency of neuropathic traits in the uncured appears to be definitely proved. Inasmuch as the grosser and more readily recognizable neuropathic types were supposed to be excluded from the American Army and particularly such contingents as were sent abroad, and that this Army was the only one to undergo such preliminary neurological sifting, there ought to be found a smaller incidence of neuropathic types in the neuroses of the A. E. F. than in any of the Allied armies. This may account for the small percentage that has been stated—though among some of the more enthusiastically inclined neuropathic statisticians, the percentage was found to be as high as in the unsifted armies of England and France.

Fear and fear reactions certainly cannot be set down as neuropathic traits, and as they are the most important energizing factors in the etiologic sequences of war neuroses, it follows that any soldier, neuropathic or not, may be viewed as a potential case of war neurosis. This, after all, seems to be the most illuminating point of view and by far the most useful, and as such it fits in with the conception advanced in this paper. As a possible predetermining influence in the series of incidents leading to the development of war neuroses in a soldier, neuropathic inheritance has some importance, but an importance completely overshadowed by the more active set of traumatically converging incidents, which will now be described.

PSYCHOLOGIC MECHANISM

In order that the mechanism of automatic defense may be set to work, the average soldier must undergo a series of events which tend to weaken what may be roughly and rather inexactlly termed his ordinary self-control. By this is meant that he must be put temporarily in a condition where his normal mechanism of inhibition is seriously weakened. By inhibition in this sense is meant the totality of his power to control the natural exhibition of the phenomena of

fear, terror, nervousness, horror, etc. To this must be added the positive factor which strengthens the inhibitory impulses — that military quality which keeps alive and ever present in consciousness the recently acquired traditions and customs of a soldier. This is an element of morale. The mental process by which this is accomplished is suppression or repression. Inhibition is merely a larger and more physiologic way of expressing it.

The important set of circumstances which tend to weaken this faculty are: (1) exhaustion; (2) fatigue — the more chronic phase of exhaustion, and then in succession sleeplessness, lack of food or water, worry, responsibility and incidents of a particular, horrifying or unaccustomed kind, loneliness, strangeness, ill-treatment, etc. The list of these incidents might be endlessly multiplied, but enough has been set down to indicate their character. The importance of incidents like those that have been mentioned and others of a similar kind lies in the fact that they tend, each of them or in combination, to weaken the individual and to prepare the way for the reception of the final traumatic incident. They create in the soldier, so to speak, a favoring terrain; they further tend to develop in him a soil of receptivity, in which or on which the neuroses given the proper setting can easily develop, become fixed and chronic. In opposition to these, the soldier, according to his peculiar personal make-up, struggles either forcibly or feebly according to the measure to which he has surrendered himself to his career as a soldier. Back of all this lies no doubt many an emotionally-tinged impulse, leading straight back to his former-nonmilitary existence. Among these may be mentioned the mass effects of discipline, or morale, the grip of idealism which led him to offer himself as a fighter, his experience with the German as an antagonist, the memory of slaughtered friends or comrades, his love for his officers, the honor and reputation of his regiment, and things of that sort; all of them or some of them are present in the make-up of every soldier. They form the counterflow against the on-rush of factors which center about the condition called fatigue or exhaustion. It is to be noted that in whatever stage of fatigue the soldier now happens to be, he is still in possession of consciousness and a knowledge of himself. In no way has he departed from the condition of a consciously controlled human being. No matter how feebly the inhibitory impulse is asserting itself, it is still to some degree active, and to that extent the soldier is aware of himself as a soldier, perfectly responsible and responsive to the demands of his position. It may be argued that in the extreme stages of fatigue, the condition of automatism may be reached, but even if this were so, its approach is too gradual to permit of the neurosis structure instinc-

tively fortified by the necessity of self-preservation, to take complete hold of him. At this stage there comes into play a very important and significant psychologic element in fatigue. This is a very unusual and possibly suddenly developed state of suggestibility. This extraordinary state of receptivity not only to outside things, but also to ideas, memories, and emotions of endogenous origin, form, perhaps, the most favoring circumstance for the development of the neurosis which at this moment is awaiting an opportunity to enmesh the individual in its defensive system.

From this point on two sets of things may happen. Both of them have a precipitating effect and both tend to act in a positive and dynamic fashion equally effective in the production of the first and necessary phase of a war neurosis. One set of incidents has to do, in a certain proportion of cases, with the purely mechanical results of a shell explosion in the immediate neighborhood of the soldier by which he is shocked to a greater or less degree, so that there is momentary loss of consciousness, or it may extend over some hours as the case may be. As a rule, he either falls or is thrown to the ground, or wanders about in a confused way, and immediately enters into a state in which conscious inhibition is for the time being totally in abeyance. The other set of incidents has to do, not with a mechanically working factor, but with the appearance on the scene of some sudden, unusual or terrifying experience which emotionally overloaded tends to produce exactly the same condition.

The question of concussion around which so much controversy has arisen was not an important cause of dispute in the early years of the war. Even as late as 1917 and up to June, 1918, the most common etiologic fact in a case of war neurosis was that of shell explosion and the resulting concussion, but as the fighting on the Western front began to open up the importance of this factor tended to lessen, though not enough to make it take a secondary place in the list of causative moments. In the earlier days of the war the explosive incident was often combined with a burial experience; that is, the soldier was not only thrown in the air but was covered over with trench débris of all kinds, the two forming a twin traumatic incident which often has important consequences in the symptomatic sequence which followed. In the A. E. F. experience burial incidents were rather infrequent, a fact which decreased by so much the emotionally laden incident, which later became one of the most important of the fixation mechanisms.

The very constant reports in a soldier's history, as given by himself, of a shell explosion experience led the B. E. F. medical service to inquire more exactly into its accuracy. For a time shell shock

could be diagnosed only if there was documented evidence by witnesses of a shell explosion near enough to a soldier to produce a concussion effect. In some instances the soldier's recollection of what happened was not supported by the reports that came from the front. How large the error finally turned out to be is not known to the writer, but that the doubt was sufficiently important to warrant the effort of investigation is of importance here. No attempt as far as is known has been made in the A. E. F. to obtain exact statistics on this subject, and all that can be relied on is the account given by the soldier as far as he can remember, and on the symptomatic sequence of events which he presents. These are, as a rule, unmistakable and can scarcely be imagined by the average soldier. Whatever the percentage of shell concussion experiences in cases of war neuroses may be, it still remains, in a large series of cases, the most important of the immediately working traumatic incidents. It was so important a factor that at one time concussion and its resultant neuroses became a very important, perhaps, all things considered, the most important group in the entire classification from a percentage point of view.

Whatever the immediate factor may be, a period of unconsciousness, confusion or a dazed condition appears to be one of the most significant and almost necessary preliminary states favoring the development of a neurosis. Such a condition offers to the protective mechanism the opportunity to work, unaffected by the ordinary control of the touch with reality, which is implied when consciousness remains undisturbed. That a neurosis can develop without an intermediary state is of course true, but in these instances the mechanism at work is of a much slower and more complicated kind leading to approximately the identical condition through endogenous processes largely activated by emotional hyperreactions, breaking through consciously acting repression.

Looking at the thing as a process, and nothing else, there is evidently a state reached by the soldier going into a neurosis when, for the time being, his conscious control is weakened or lost, and at that period the instinctive reactions take possession of him, and uncontrolled by anything that he can at that moment interpose to counteract it, opens the way for the self-preservation instinct to obtain its fullest influence. At any rate, he remains under its control until one of two things happens. One leads back directly to the restoration of himself in his soldier capacity, in which instance no neurosis develops; the other, further and further away from his normal soldier self into something totally unlike and alien to the thing that he was, and then he begins to show one of the many types of the war neurosis.

In the course of this process another important element in the mechanism comes into play, especially during the period of transportation to a hospital and in the early days of the soldier's stay there. The process by which the initial symptoms become either temporarily fixed or tend to further elaboration has been described by various terms. None of them are, however, very satisfying. What happens is that there is given an opportunity for more complete concentration and introspection so that the individual removed from contact with his accustomed environment and away from the external influences of camp, line and military discipline, easily surrenders himself to his neurosis, which automatically tends to further elaboration and intensifications of symptoms. If this is not counteracted by skillfully planned medical intervention, intensive, and above all promptly put into effect, the war neurosis subject falls under the complete sway of his neurosis and the picture becomes completely that of a well developed and chronic type. That there is more at work in this stage than pure automatism and unconscious impulses must be admitted. That there gradually develops a fairly active desire not to get well, but to remain in the apparently safe grip of the neurosis instead of facing a return to conditions which lead to its production seems also evident. There is also here seen the beginnings of another process—that is, a struggle between the innate desire to return as a soldier and the automatic persistence of the preservative tendency previously alluded to. Cases left untreated, neglected, or contemptuously handled rapidly develop into this state, and as a result form the most difficult subjects for subsequent treatment.

There is a group of cases to which much that has been described above does not apply. It is mentioned here because it occurs in a condition very largely met with in the officer class and which may or may not have as an etiologic factor the acute traumatic incidents seen so frequently in the soldier types. The anxiety neurosis has a mechanism which is more complicated and in which the defensive element is obscured by the presence of an intense and persistent conflict. This conflict has its origin in the necessity, which an officer at all times is conscious of, to conceal from the men under him and from himself too, every evidence of emotional stress he may be passing through. This he does by the use of repression. The repressed material of his experiences, notably those in which emotional loading is strongly present, activate the conflict between his desire to maintain and follow the tradition and training of an officer and the strongly entrenched but completely unacknowledged instinct to save himself. The essential difference between his reaction to the sequence of traumatizing events, just described, and that existing in the case of the soldier, lies chiefly

in the fact that there is an ethical element at work which intensifies the conflict and causes him, in many instances, a great degree of mental distress, suffering and self-accusation. This produces the state of anxiousness which is often the only and sometimes the chief evidence, externally at least, of his neurosis.

It is not to be inferred from this that only the officer class can be afflicted with this type of neuroses. Any soldier, especially one of some education or in whom there exists a well developed ethical sense capable of introspective attention, may show this type of neurosis. Indeed, in the A. E. F. there was a much larger percentage of soldiers with this type of neuroses than was found in the B. E. F., due no doubt to the generally higher degree of education and selection made possible by the larger man-power available.

The anxiety type of neurosis presents a much more highly developed, pure, psychologic defense than the other forms. Its relation to physical factors is often much more difficult to demonstrate. In fact, it is often found developing after a rather long sequence of psychically acting traumas showing markedly insidious progress and evidently originating from insignificant and not easily demonstrable beginnings. Its defensive character is chiefly in the fact that it renders officers incapable of positive action, reducing them to a state of neutrality. In this condition he becomes, one might almost say, the prisoner of his conflict, and remains inert, without energy, without initiative, controlled almost wholly by the emotional stress engendered by the conflict going on within him. He is frequently unaware that such a conflict is present, the repressing mechanism working automatically to keep out of his waking consciousness all evidence of a thing of this sort. What he is aware of, and that very acutely, is his own mental distress and the physical expression of the emotional strain he is under. These external signs of fear, worry, etc., are dissociated in his own consciousness from the sources to which they owe their origin, and he is thus as much a puzzle and mystery to himself as he is often to the neurologist under whose care he may happen to be.

Several bits of qualification must be added to much of what has been written in this attempt to state the clinical problem of the neuroses from the point of view of its underlying mechanisms. It is necessary to appreciate the fact that in trying to trace the sequence of happenings which a soldier passes through on his way to a neurosis, an average of such experiences was recorded, something that might be accepted as a plan of a physiologic experiment if the soldier could be made into a laboratory problem. There is no thought of making this entirely applicable to every case of war neuroses, or, in fact, is it certain that any one ever passes through just the things that were

described. Of all things in the world the war neurosis lends itself least to dogmatic statements, but what has been set down appears to be a reasonable explanation based on an analysis of many hundreds of cases.

It may seem curious to use the possessive in speaking about the neurosis. The expression "his neurosis," has been used frequently in this paper. The purpose of this was to hint at the very personal character of these defense systems, and any serious study of such cases will show the interesting fact that to each war neurosis subject the symptoms do become personalized, unique and individual. Thus in attempting to describe them, expressions having the touch of ownership, appear to be warranted.

The clinical problem of war neuroses, then, may be summarized in some such way as this: There is a set of determining factors sensitizing the individual to the one or set of direct causative incidents. These, as a whole, are capable of being set down in the order of their assumed importance. The immediately determining factor has a definite traumatic quality, either mechanical, as in the case of shell explosions, or emotionally directive in the case of unusual or terrifying experiences. A certain degree of initial disturbance of consciousness appears to be either necessary or a very favoring circumstance for the development of the neurosis structure itself. The disturbance may be anything from a slightly dazed condition, associated with some degree of confusion, to complete loss of consciousness lasting several hours. Associated with the disturbance of consciousness there develops some degree of automatism, or a stage in which conscious inhibition is so lost or weakened that the individual becomes a primitive organism reacting to the primitive processes of instincts. In this state the instinct of self-preservation asserts itself. Instead of instinctive flight or concealment taking place, a manifestly impossible condition in most instance, there develops the manifestation of various forms of the neuroses which replace them. These take such form as may be modified by the peculiar circumstances in which the individual finds himself at that time and also according to his make-up. From the temporary fixation of symptoms the rest of the clinical manifestations of the neuroses tend to unroll themselves influenced by the peculiar mechanism which was then set in action. The neurosis tends to elaborate, become fixed and stereotyped after the initial stage according to the individual experience of the soldier, his surroundings, the kind of hospital he may be in, the character of his medical treatment, the attitude of his nurses and doctors toward him and other circumstances of a similar kind. At first the neurosis is entirely automatic, the product of a mechanism entirely out of the control of

the individual. Later, there enters into the problem some measure of responsibility for the further maintenance of the neuroses. At this place in its development a cure must be effected if the patient is to be restored to his former condition.

As was previously stated, the attempt to classify such cases as came to Base Hospital 117, and their number amounted to 3,000 cases, was made for the purpose of so grouping them that more exact study would be possible, and that the mechanism underlying their production could be more effectively inquired into preparatory to a more direct method of treating them. It was apparent almost from the start that there were cases that seemed to correspond almost exactly to types met with in civilian neuroses and to these the terms commonly used there could be applied.

What appeared to be necessary, however, was a redefinition to meet the conditions which the stress and strain of war implied so that the designation war neuroses might be justified.

NEURASTHENIA

There was a group of cases in which the chief evidence of disease was a very evident and intense condition of fatigue, the chief neurosis element of which was a marked subjective sensation of tiredness. Fatigue was an essential accompaniment to all muscular and mental effort as it was to all special sense activities. In such cases it was possible to demonstrate the presence of a fatigue reaction, which can briefly be described as an over-response to a minimal stimulus, or rather an over-effect to the resultant of a minimal stimulus. To such cases it seemed that the designation neurasthenia might be given. In this group, a very small one by the way, all the presenting symptoms were interpreted and analyzed as depending on the factor of fatigue, and this factor was further amplified by its subjective incidence. In other words, the primary experience with an intensely fatiguing series of incidents was carried over into the neuroses as a fixed and powerfully acting preventive toward any moderate muscular or mental effort. The emotional background secondarily produced was that of a state of simple depression with a concomitant factor of irritability.

The protective quality of a state such as this is clearly evident and needs no further emphasis. Such patients presented all the symptomatic evidences of a typical neurasthenic of civilian life, with this difference—they did not show the physical appearances so commonly met with in the usual neurasthenic types. When they did it was certain they were not war neuroses alone, but the development of a war neurosis on a condition that had existed prior to enlistment. Two types could then be recognized: (1) a neurasthenic differing in no

important way from the neurasthenic of civil life, and (2) an acute acquired neurasthenia—that is, a definite clinical variety of war neurosis. The distinction became the more obvious when it was noted that the acute cases presented few if any of the organic characteristics of the old neurasthenia, very few of the vasomotor disturbances such as sleeplessness, cardiac irritability, etc. Some of the extreme cases eventually did, but as a rule the evidence of neurasthenia was centered rather about the subjective sensation and its controlling power on the patient's activities than on the physical reaction due to disturbances of an internal kind.

What appeared to determine the presence of the neurasthenic type of war neurosis was rather the effect of a previous state of exhaustion, an acute experience which led to its further elaboration as a neurosis. That out of this could and did develop the typical neurasthenia was likewise true. Of all types of neuroses, perhaps the neurasthenia cases gave the poorest prognosis and resisted treatment most stubbornly. The absence of previous symptoms of neurasthenia in many of these cases except the congenital type, led to the attempt to place them in a special class and very quickly they came to be recognized as characteristic but not common clinical pictures. Another part of this picture was the fact that there was nothing mysterious to the patient about his symptoms, their cause or their significance. No conflict of any kind seemed to develop. Its mechanism was automatic but wholly and completely conscious.

PSYCHASTHENIA

The second group which early differentiated themselves were cases in which doubt was a prominent symptom. In such instances there is little evidence of fatigue, or none at all after a short period of rest, or, indeed, without it. Such patients were capable of considerable mental and physical effort, but they complained chiefly of doubt, hesitation, and an almost complete incapacity of choice. To this group, not a very large one, the term psychasthenia was given, chiefly because the symptoms corresponded accurately to the psychasthenic condition of civilian neuroses. Here two types began to show themselves; one, the typical psychasthenia of other days—the congenital scrupulous type, the exaggerator of small differences, the individual incapable of making decisions owing to the conflict of differences; fear as a consequence of choice preventing decision. The type is too well known to warrant any further description in this place. The other was an acquired state similar to this without a previous history of this kind.

If the condition of psychasthenia is reduced to its simplest expression, incapacity of the function of choice appears to be its primary

departure from the normal. It is the fear of the consequence of **choice** through experiences or through the anticipation of what the **choice** may bring about, that creates the static condition which is the **chief** characteristic of the psychasthenic's attitude toward events which **tend** to focus on him.

The term in Janet's sense seems to have too broad an application for the type which develops among the war neuroses. Here it is **seen** more as an evidence of the peculiar twist which the neurosis in its defensive adaptation causes. Perhaps, as is so often the case, the type that the neurosis finally develops into depends on some congenital peculiarity of the individual or on some experiences in his **past life**, which are awakened and are set again into activity by the more recent emotionally-tinged traumatic incidents. An attempt to connect up the acute psychasthenic symptoms in war neuroses with events long past and forgotten with the purpose of proving this point was not successful. This was done with a small group of non-coms, sergeant-majors in the B. E. F. No tangible connection was found, as these men **particularly** were apparently of the most normal antecedents, and men to whom, at least before they became subjects of war neuroses, decision and choice were second nature. Strangely enough in the B. E. F. this type of man was found frequently belonging in this group. Indeed, they were the professional soldier class, men with years of service who came to France in the early months of the war and some of whom had seen almost four years of fighting. The group stood out with great clearness chiefly on account of the type of soldier which belonged to it and because there was an almost total absence of all other traumatic disturbances; it was significant, also, because fatigue in the sense of the previous description appeared to be almost totally lacking.

These patients were puzzled, not because they had any doubt in their own minds as to the thing that had happened to them, but because they could not understand why it had happened. Here again as in the neurasthenia group the process seemed to play itself out in active consciousness, the patient being perfectly aware of his condition and perfectly able to tell what it was that was disabling him. There was no evidence of a dissociation process, and no intermediary mechanism was necessary to bring all the facts of his condition to the attention of either the physician or himself. In this instance, likewise, the process was an entirely conscious one, open to the fullest inquiry, needing no method of associative analysis either in treatment or diagnosis.

HYPOCHONDRIASIS

The next group is the third of the consciously produced neuroses, and to this the term hypochondriasis was given because it so exactly fulfilled the condition on which such a diagnosis would have been made in pre-war neuroses. This group was also a small one, perhaps the smallest percentage of incidence in any of the groups. Indeed, it is questionable whether a pure hypochondriasis can develop *de novo* from war experiences alone. In almost all cases in which this diagnosis was made, a previous history of this condition could be discovered. The pre-war conception held by the writer of the mechanism of this disease seemed in every way applicable to the same kind of thing met with in war neuroses. Hypochondriasis is perhaps the most perfect type of a defensive neurosis because it touches a fundamental and primitive tendency found among all peoples, that is, the automatic release from duty, responsibility and work in the presence of disability or sickness.

The mechanism consists of two intimately related things. First, there is evidently present in these patients an abnormally low level to receptive impressions from the external world; that is, the skin and special sense mechanisms are capable of transmitting a greater bulk and variety of sensory impressions and having them perceived as impressions, than is found among normal individuals. This lowering of the sensory level is also found in the receptive mechanism having to do with sensations arising from within the body, probably through the autonomic system. This intensification of the sensory margin has its chief effect in developing an increased capacity of attention — that is, the hypochondriacal individual has not only a capacity to become aware of a flood of unusual and strange sensations arising externally and internally, but has his capacity of attention sharpened to their perception when received. By that very sharpening of attention the facility of final interpretation of such sensations is increased. He thus becomes aware of a constant inrush of sensory impressions which tend more and more to occupy his field of consciousness. This mass of wrongly interpreted and wholly new and strange sensations is the crude material out of which the neurosis is fabricated. This fabrication takes on the picture of disease which becomes more and more definitely personalized as the process goes on. Naturally the experience with or knowledge of disease together with the suggestions obtained from observation, rumor and surroundings influence the variety and dramatic quality of the particular disease in question. The collection of ideas concerning disease tends to occupy more and more the patient's field of active consciousness so that he lives practically controlled by them. When he responds to a constellation of this kind

more than he can possibly do to the world about him, when his mental life spins eternally about this or that picture of disease, which at all times fills his field of consciousness, the complete picture of hypochondriasis may be said to have developed.

This completed picture should be sharply differentiated from what may be called a hypochondriacal attitude. This latter is very common among soldiers, but only as a temporary state which quickly disappears with rest and improvement. The true case of hypochondriasis shows no change under either condition and apparently is uninfluenced by treatment of any kind. It has been said that true hypochondriasis is rarely found as an acute or acquired type of the war neuroses. This is in a measure true, but it is quite possible for a clinical state closely resembling this to develop on the foundation of a slight and often insignificant or passing trauma or condition, insignificant in proportion to the more dramatic kinds of traumas so frequently mentioned in this paper. For example, it was sometimes found that a soldier who had been previously operated on for an appendicitis would, under the influence of a series of traumatizing events, develop a neurosis of this hypochondriacal type which appeared to center about the operation or the scar remaining as an evidence of it. Previous to such an experience the whole appendicitis incident has been completely forgotten, but suddenly there developed a complete picture of postoperative adhesions, pains and a widespread area of scar tenderness. From such a beginning the whole picture tended to spread, involving neighboring organs until the patient was entirely in the grip of an ever-spreading collection of disease ideas. It is of some significance that in such cases the therapeutic outlook was more encouraging than in the type previously mentioned.

It is necessary to emphasize once more that the hypochondriacal tendency is often found entirely dissociated from the true neurosis, but even in its partly developed form, the essential mechanism as described could easily be demonstrated; that is, the increased capacity for automatic attention and the lowered threshold of sensory receptivity. In hypochondriasis, again, the neurosis is consciously determined and thus belongs to the group of which neurasthenia and psychasthenia are members. These three, then, form the first subdivision that is consciously originating neuroses. Again, this does not at all imply that they are either willfully or designedly produced, but that they play themselves out in the upper zones of consciousness and awareness.

HYSTERIA

By far the most striking of all the war neuroses, clinically at any rate, are the hysterias, as the anxiety neuroses are the most subtle and

intangible. These two are taken together because both represent unconsciously producted neuroses, and both are types of a dissociation process. The one shows itself by dissociation of motor, sensory, special sense functions, and in some instances of the function of memory; the other, by purely psychical forms. The one—hysteria—showing no evidence of conflict; the other—anxiety neurosis—arising out of a conflict with a strong moral or ethical component. Hysteria was regarded as being, in a sense, a type of cortical dissociation, very often almost anatomic in its demonstration; the other has to do with much deeper and more illusive qualities of consciousness touching more closely on the factors concerned in personality. Another striking difference lies in the reaction to therapy. Hysteria was the most easily cured of all the neuroses, anxiety the most difficult. A curious and interesting point of difference was found in the fact that in hysteria there was little relation to pre-war conditions or experiences. In the anxiety neurosis analysis often led back directly to pre-war conflicts in which the same or similar elements could be demonstrated. They did not necessarily give rise to a neurosis then because the repressive mechanism sufficed to tide the patient over, but it was often easy to appreciate how definitely the stage was set, as it were, by virtue of the patient's former experience with conflict processes of a less intense form.

Hysteria is then to be considered as a type of war neuroses caused by the mechanism of dissociation, by which functional activity either in its motor, sensory or psychical capacity is blocked from consciousness and conscious control. If an organ of special sense is involved the dissociation process tends to separate out one or more of its coordinating functions from the control of the complete mechanism. The part or parts in either instance divorced from consciousness can maintain itself in one of three ways. It can cease to act at all; it can act abnormally—that is, in a qualitative sense, or it can hyperact—that is, in a quantitative sense. In other words, there can be paralysis, uncoordinated or perverse forms of action or convulsive-like movement. This same thing is found naturally in the sensory and special sense fields. The dissociation process is most frequently set in activity by a somewhat sudden emotional or physical shock and, if in the latter instance, the precipitating factor is most often the effect of a shell explosion or some type of trauma associated with some degree of violence. The type of reaction in hysteria both in respect to localization and function bears a definite relation to the local effect of the trauma. Blindness is often the result of the acute blinding sensation of an explosion, deafness due to the momentary loss of hearing. For the same reason, sensory disturbances are due to numb-

ing of areas of skin following disturbance of atmospheric pressure in the zone of an exploding shell, etc. The emotional precipitating factors have the same curious localizing tendency, with the exception that here suggestion or imitation seem to show a more active influence. It is necessary to point out that in hysteria, particularly the acutely established types, show less clearly the characteristic protective defense than in some other types of neuroses, and it must be admitted that in some instances it is only after the primary disturbance has manifested itself, whatever its nature may be, that the defensive mechanism is set to work and then chiefly in the direction of fixing it and making it more permanent.

A sudden shock having a positive degree of physical incidence may throw out of activity a certain function or a part of it, certainly too rapidly for any kind of psychical mechanism to be set going. In such instances the instinctive action of self-preservation arises later automatically making that loss of function fixed, thus establishing it as a neurosis of the war type.

Such a conception of hysteria is a departure from the usual thinking on this subject and naturally differs essentially from the theory of Babinski so much in vogue in the literature on war neuroses, but it seems impossible to escape from some notion of this sort, in the face of the almost instant appearance of symptoms after an explosion incident and the tendency to fixation and the elaboration of the symptoms following the slow return of consciousness. Whatever rôle suggestion plays, it surely can be regarded as only part of a much more complicated mechanism and not the only factor at work. One of the most interesting phases of hysteria in its war neuroses coloring is the amnesias, and these may be regarded as pure types of dissociation in the purely psychical sphere, and they obey apparently the same sequential rule as the cruder forms of response. The single and most reliable diagnostic evidence of hysteria is found in the presence of the dissociation process. When the symptom is capable of being described as due to that, and if it meets the necessary requirements of an hysterical symptom, not necessary to mention here, the diagnosis of one of the many forms of hysteria found in the war neuroses can be made.

Another characteristic of an hysterical symptom is that in its disappearance it may pass through any one or a combination of the three forms which have been described. Complete paralysis often recovering through the phases of tremors, exaggerated movements, etc., aphonias recovering through the phase of stammering, etc. The synthesis with consciousness very often is not direct and immediate, but indirect and incomplete.

ANXIETY NEUROSES

It is in the anxiety neuroses that the most complete example of psychical dissociation is met with — that is, a dissociation unaccompanied by anatomically expressed loss of function. It has to do with a more general process and reaches down more deeply into personality than the more superficially located mechanism seen in hysteria. Something of the etiology and the primary reaction have already been touched on. There remains to describe progress and final clinical results. The subject of an anxiety neurosis must be thought of as an individual in whom the repression faculty is well developed. This may come about either as a personal characteristic, or it may be due to the position of authority due to his military position. Naturally the officer falls most easily into this class, and it is in the officer class that the majority of instances of anxiety neuroses are found. Next would come certain types of the noncommissioned officers, chiefly such as have received their commissions recently, and then soldiers who by virtue of education and the development of higher standards are inclined to react easily to ethical considerations. While this may be the general type which develops this form of neurosis, there are always found exceptions which apparently do not fit into the conditions as set down. Such exceptions are probably insufficiently studied or understood.

In the typical case and for the purposes and necessary limits of this paper only such can be considered, there is present, almost from the beginning, the essential elements of the mechanism of an anxiety neurosis. These are conflict, repression, not only of the memory of the experiences themselves, but also of the expression of the emotional reaction associated with them, and a certain degree of what may be called the ethical point of view in the presence of the antagonism between what is regarded as the right thing to do and the natural innate tendency toward self-preservation. These, of course, form only the basic groundwork of the process, indicating enough of the mechanism to warrant grouping these cases in a class by themselves.

In almost all instances an officer very early in his career, very likely even in the training camp, feels the necessity of repressing his dislike or objections to discipline, obedience, authority and many of the other essential phases of military life. His repressive mechanism not only has to do with the ideas themselves, but also with the external evidence of his attitude toward them; that is, his conduct must depart in no way from the correct military form. For these, and indeed for most of the experiences associated with actual combat duty, the repressive function is amply sufficient to keep the officer from ever approaching the territory of the neuroses.

The repression faculty has a well known tendency to become automatic and to act entirely without the intention of the individual. As the officer advances in his training, and as military life grips him more and more intensely, and as military discipline forms him into a silent part of the big army machine, he is less and less in need of any active manifestation on his part of this faculty of repression which was so much a part of the mental discipline of the earlier days of his training. It must not be forgotten that in the A. E. F. the professional class of officers was necessarily a small one and that most of the non-professional officers were taken out of civilian pursuits of various kinds in which no trace of military atmosphere and certainly none of active combatant duty were to be found. Therefore, there was no important set of military, or officer traditions to which the future officer had long ago accustomed himself. In England, of course, there was, and there is no doubt that this had a definite influence on the number of anxiety neuroses among them.

Therefore, it should be appreciated that in our Army the traditions of conduct in general and particularly those associated with active military life had been very recently acquired, so recently that they were only superficially grafted on the officer's personality. There was need, then, to exercise, whether consciously or not, that form of inhibition called repression in order to maintain such traditions under circumstances of difficulty. This was especially necessary when the officer met front line conditions for the first time, when he had not only himself to keep in hand, but also the added responsibility of men under him for whose fortunes in the stress of trench or open warfare he held himself in a measure responsible. In addition to this he realized that the technical side of his profession, a most difficult and intricate thing, was also but recently and often most laboriously acquired and had now to withstand the actual and often bitter test of real combatant conditions. Notwithstanding these heavy burdens, very few officers, it must be acknowledged, did even, under the adverse conditions associated with front line conditions, develop a neurosis. Those who did, had to face peculiar sets of circumstances which tended to break down the inhibitory processes which held them together in their capacity as leaders of men. Under the strain of fatigue, exhaustion, worry and some of the many incidents that have been before alluded to and as a result of shell explosion with a concussion sequence, the faculty of conscious inhibition was temporarily lost and the officer acted for the time being as a primitive instinctive piece of human machinery and during the period of semi-automatism, confusion or haze, the beginning of the neurosis of the anxiety type was laid. If some of these things did not happen in an acute manner, then a series

of smaller and less important incidents brought the officer in exactly the same condition.

From this time on, the conflict began to assert itself coupled with the dormant repressive tendencies, which again came into activity as the reality of the situation became more and more apparent. It is this antagonistic relation of conflict to repression that tends toward the separation of emotion from experience. This supplies the mechanism of dissociation alluded to before. There results then the clinical picture of a state of intense anxiety with the external evidences in the way of facial expression, depression, apathy, anxiety, loss of sleep, dreams and even the objective appearance of fear, tremor, rapid pulse, vasomotor reactions, in the face of the complete unawareness and lack of understanding on the part of the patient, of what really is at the basis of his discomfort.

The battle experiences repressed, and in a sense partially forgotten, tend to express themselves by freeing their emotional content or by spinning themselves out in dramatic and terrifying dreams. There is present, then, the evidence of fear and terror without being related to either actual experiences themselves or even to the actual memories of such experiences. In this state there develops a series of conflicts which must be regarded as being hardly conscious in some instances and wholly so in others. These seem to have been the more usual. (1) The conflict between the desire to go back to the front and the negative desire or wish for self-preservation. (2) The conflict arising between tradition and training of an officer and the desire to escape front line conditions. (3) The conflict between the desire to avoid the dangers and discomforts of the front, and previous ideas of duty, valor, etc., and family, social, personal and class standards. (4) Conflict between the desire to escape and the feeling of inadequacy, in a military sense, of the responsibility of an officer in command of men. (5) Conflict between the impulse to go forward and the wish, expressed or not, to go back to former conditions in the United States. (6) Conflicts which have reference to events or similar types of conflict in pre-war experience.

Naturally there are many other kinds of conflicts, but these were so common in the cases seen in Base Hospital 117, that some of them were predicted in certain individuals and were actually found to be present.

Enough has been said of anxiety neuroses to indicate at least what is believed to be its fundamental mechanism, and to establish the fact that such a group of cases exists characterized by this mechanism. Less space will be given to the other groups because their mechanism is less individual and the types much less sharply differentiated, and

because more and more they represent direct etiologic and symptom-ological types of classification.

ANTICIPATION NEUROSES

The anticipation neuroses were so named because they represented neuroses reactions, not to actual experiences in battle, but to the anticipation of such experiences. The neuroses, therefore, acted not as protections against the repetition of events already lived through, but as protection against initially experiencing them. As a whole, they probably were patients who had shown symptoms of the neuroses in training camps at home, but the manifestation of which had not completely developed. On the way over or after they reached the concentration camps in France, the symptoms bloomed out again, and under the spur of immediacy rapidly took on the characteristics of a well defined neurosis picture. The anticipation group was never a very large one and rapidly declined after active fighting began. They formed less than 10 per cent. of the total material, evidently most of them were excluded by the neurological examinations made in the home training camps. Any of the clinical types of neurosis could be found in the anticipation group. This appeared to show that the memory of a past experience, imitation, suggestion, rumor—if emotionally intensified sufficiently—could, in given instances, arouse the defensive instincts to take the form of a neurosis, in the presence of a sufficient degree of receptivity and expectancy on the part of the individual.

The anticipation neuroses are not war neuroses in the narrow meaning of the term, but it was found necessary to include in a classification and to place in it such cases as had never been at the front, as well as a few patients who developed the attitude of anticipation toward re-experiencing former experiences. They reacted similarly to the group for whom the anticipation neuroses was at first devised.

EXHAUSTION

Exhaustion has its place in a classification of war neuroses because it connotes defense of a chemical or polyglandular kind. These patients came into the hospital in some numbers at first, but with the establishment of the forward area hospitals fewer were seen. They represented a large percentage of the material seen in the *triages* and a considerable number of those seen in the advanced hospitals. In the earlier months of fighting they were often mistaken for and designated as war neuroses. As forming the foundation on which the neurasthenia type of war neurosis often developed, they deserve some mention here.

EFFORT SYNDROME

Very little will be said about the effort syndrome in this place. So much has been written about this condition, and there is still so much controversy on the subject that nothing can be added toward clearing it up from the point of view of its place in a list of war neuroses types. It was common enough in the material at Base Hospital 117 and formed so distinct a picture that it was one of the most easily classified. From the point of view of its defensive quality it is a typical neurosis, associated with the exhaustion types, but was a more definite localizing quality. It frequently followed gas poisoning, being the most persistent perhaps of its after effects. Its close association with emotion and the emotional reactions of the cardiac and respiratory functions seem to justify its position among groups of a functional defense system. Clinically, it is too well known to describe here, and it is mentioned because mechanistically considered it ought to have a place in any classification of the neuroses.

STATE OF ANXIETY

Timorousness, or a state of anxiety, was a term given to a small group of individuals who frankly admitted that they were afraid to face conditions at the front, and deliberately gave way to this fear, refusing to accept or develop any compromise between themselves and what they had to do as soldiers. These are the true and only types of cowards. In them no repression of the kind mentioned here exists. This is not a neurosis, of course, as the whole mechanism is entirely too open and frank. At first sight such cases ought to be dealt with outside of a hospital, but in the case of a soldier the condition was so strange and departed so much from the usual conduct of a soldier that such an individual was not considered normal enough to be handled from the military side alone. They would belong probably in the same class as the conscientious objectors, the difference being in respect to the kind of thing that interfered with their willingness to act the part of a soldier.

GAS AND CONCUSSION

Under gas and concussion were included cases in which the primary symptoms of a concussion or gas experience were elaborated into the structure of a neurosis by the mechanism of fixation and defense. In the concussion neurosis the headache, vertigo, amnesia, temporary blindness, instead of passing away in a few days, as they normally do, begin after a comparatively free interval to become apparent again, with a definite degree of persistence and exaggeration

which had all the characteristics of a definite neurosis. In the gas neuroses the hoarseness, difficulty in breathing, pain in swallowing or talking, pressure sensation in the chest, dyspnea, etc., show exactly the same tendency until there developed a chronic picture of gas poisoning long after the acute symptoms had any right to be present. In gas, too, the actual pain of a skin burn persisted as a widely spread burning and paresthesia, long after the primary burn had healed, and all trace of it had completely disappeared. The syndrome of both of these types were included, because at times such patients were sent down to the hospital either through a mistake in diagnosis or on account of transportation necessities.

MALINGERING

Malingering is of course not a neurosis and it is included in the classification in order to take care of all possible types of cases. No diagnosis of malingering alone was made, chiefly because this has become largely a military and not a medical question. Unqualified and complete malingering was so rare that it was almost negligible. The classification or grouping has shown that the different types depend rather on certain sets of distinctive mechanisms and on certain almost specific traumatizing experiences than on symptomatology or on the final clinical picture. It is therefore necessary now to describe some of the more general symptoms common to many of these types and then to touch on some of the more general of the mechanisms.

Three are selected for description under the latter head, noting (1) what may be called by analogy with general medical description—the reactions of the organism as a whole; (2) the fixation process, especially in its initial stage, and (3) the convalescent conflict.

There are certain symptomatic reactions of the organism to emotionally effective traumas which represent its protective response as a whole and furnish the symptomatic background of the neurosis. As has been shown such symptoms are capable of elaboration, fixation and stereotypy according to the type of mechanism set in activity. For this reason some or all of those about to be mentioned may be found in any of the groups which have just been described.* They may be regarded either as instantaneous reactions taking place at the moment of traumatic impact, or arising afterward as a result of the emotional responses accompanying the traumatizing incident. These are, in the main, primary fear reactions, such as tremor, dyspnea,

* No clinical description of the war neuroses will be attempted in this paper, chiefly because it has been admirably done, especially by Babinski, by many English writers, by Macurdy in "The Anxiety Neuroses of Officers," and by many others, too numerous to mention.

tachycardia, sweating, sense of muscular weakness, etc., and the resultant condition of headache, restlessness and insomnia. All of these may be regarded as vasomotor in origin and purely physiologic in expression. They appear to be so closely associated with hyper-emotional states seen in other than war experiences that they must be looked on as very general types of reaction with no specific war incidence at all. For this reason they are found as a kind of symptomatic background to almost all of the severer types of neuroses. Over 70 per cent. of the 1,500 cases seen in the B. E. F. service showed headache, and considerably more than one-half had insomnia. In most of the latter the insomnia was of brief duration, the headache was often very persistent. The headache in cases of concussion is somewhat different approaching closer to a specific symptom. Even in the development of the neurosis out of the concussion experience the headache had a more persistent character, a more definite localization and appeared to produce more discomfort than those found in the other conditions. The characteristic headache was one of the most significant items in the diagnosis of concussion neurosis.

It is apparent, then, that there are in the war neuroses, more or less sharply defined clinical groups, sufficiently characteristic to warrant giving to them separate neurological designations. The first six of them have a more or less characteristic mechanism; the gas and concussion neuroses are separated out because of a definite etiologic sequence, the others are questionable neuroses but should be included in a classification in use at a neurological hospital in the war zone.

INDIVIDUAL REACTIONS TO SHELL EXPLOSIONS

One of the most puzzling features of the war neuroses from the point of view of the variety of their clinical appearances, has to do with the question as to the reasons of individual reactions to a set of common circumstances. Why is it that one individual reacts in one way, another quite differently to presumably the identical trauma? What explanation is there for the fact that of twenty individuals blown up by a shell explosion, some will show a hysteria, another a concussion syndrome, another perhaps a neurasthenia, and the rest show no evidence of a neurosis at all? Whatever the notion of any trauma may be, it cannot, in the nature of things, affect every one within its zone of contact in exactly the same manner. Some, even of a small group, will not be in the line of its most intense pressure or force, others will be directly in that line, that is, the force of the trauma will be unequally directed. If disturbances of atmospheric pressure, first a rarefaction, then an inrush of replaced air, is the proper explanation of the effect of a shell explosion on the human

body not otherwise injured, it must be obvious that all persons within the zone of a bursting shell cannot be affected in the same way, there are, then, physical reasons which tend to unequally distribute the explosive effect of a shell. Then there is the varying position and attitude of the individual to the zone of explosive force. Some will present less of their body surface than others. One will be in a crouching attitude, another will be protected by the body of his neighbor, a third will perhaps have time enough to assume a protective attitude of physical defense. Thus there is a greater variety in the physical receptivity on the part of individuals exposed to the force of an explosion than there is inequality in the lanes of force acting on a given group. Therefore, there is no reason to suppose that all individuals are equally exposed to the force of a shell explosion.

There is another equally important factor and that is the *personal equation* in respect to the chances of a neurosis developing in each individual exposed. This personal equation has to do with a great variety of factors too numerous to enumerate completely. The physical condition in respect to fatigue, the mental and emotional stress previous to the incident in question, the physical make-up in point of resistance, the resiliency of body structure and things of that sort. Then, factors relating to the type of normal reaction of the nervous system, the quickness of the usual physical response to emotion—that of fear especially—the tendency to dissociation processes, the habitual set of reactions which are conditioned to external influences and many others of a like kind. These are the factors which have relation to the immediate and almost automatic physical defense seen in postures, attitudes, guarding movements, muscular spasms, etc.

It is necessary now to assume that the individual who is to acquire a neurosis undergoes the temporary stage alluded to several times in the course of this paper, that is, a condition in which conscious inhibition is lost and in which a state of automatism develops. During this phase the defensive physical positions, attitude, guarding or warning movement, whatever its special character becomes fixed and forms one of the presenting symptoms of the neurosis which afterward develops. An hysterically reacting individual will then show a paralysis, choreiform movements, or sets of muscular spasm, aphonia, blindness, deafness, or what not; that is, he will react cortically, superficially or crudely. Another type will react with the mechanism personal to him, with the purely physical expression in the background or not at all in evidence as the case may be. It is the mechanism of fixation which establishes the series of symptoms, and it is the personal and individual type of reaction that establishes the kind of neurosis that is later seen.

This explanation has been based on numerous cases studied and analyzed from this point of view, and it is merely an outline of what is conceived to be a reasonable explanation in answer to the question as to the different clinical pictures presented by a group of soldiers exposed to the same kind of traumatic incident.

The third of the phases of general mechanism can now be briefly touched on — that is, the *convalescent conflict*. This is very important in the history of a patient with war neurosis and touches very closely on his future fate, whether he returns to duty or takes his place in the partly cured, or is relegated to the rear areas or home as in the D. Class. Briefly, this conflict begins when the symptoms are disappearing and when the patient is brought face to face with the possibility of again meeting the conditions which were primarily the cause of his neurosis. The conflict is almost altogether a conscious one and such a conflict as without doubt any person in pre-war or civilian conditions might be expected to face. The pre-war patient might ask himself the question: Am I fitted to take up the duties of my previous life? The war neurosis patient does the same, but with him it is more often facing death than life. He has also to face the question of his adequacy for front-line work. If he is an officer the question of responsibility, capacity for leadership and other things come into his mind. Sometimes, if the patient is not carefully watched and as carefully treated, the neurosis from which he was emerging reestablishes itself as the best answer to his questioning, and he surrenders himself to its protecting influence, becoming in this way a permanent and an incurable case, for the period of the war at any rate.

MENTAL EPISODES

It is necessary to make some mention of the mental episodes through which some war neuroses pass. Instances of manic depressive, paranoiac and dementia praecox-like phases were met with frequently enough to warrant giving to this subject considerable study. They are spoken of here rather to call attention to them as important clinical possibilities than to describe or analyze them. The most significant thing about them was perhaps the opportunity they afforded to watch the mechanism of these types show themselves in their simplest forms and to view them as a part of the defense system of the neuroses. Particular attention should be directed to the dementia praecox episode in patient's recovering from amnesias associated with the development of complete or partial loss of personal identity. This intimate relationship between the curable types of psychosis and the neuroses, as illustrated in these episodes, should make for a clearer understanding of both. For it seems an undoubted fact that in both

there is at work often identical sets of mechanisms, and that perhaps in many instances it is due to the transportation of the neurosis structure as a social compromise which resists the development of an episode from becoming a chronic and incurable form of what is called insanity.

TREATMENT

No adequate statement of the treatment developed in a special hospital such as Base Hospital 117, can be given without describing the history and growth of the place, its spirit and purpose, and the individuals composing its staff. Therefore, the merest outline of methods used can be mentioned here. Each staff member was encouraged to work out and develop his own particular notion as to the best way to treat these cases; in this way, while many personal therapeutic technical methods were developed and often to a remarkably high pitch of efficiency, nothing new or original can be said to have been discovered. Whatever unusual facility there might have been developed in the handling of these cases came more from the importance attached to the study of the mechanism than to the emphasis on symptoms.

The cases at Base 117 represented, on the whole, the very severe types of war neuroses, particularly so in the later months of its activity. The forward screening had then become perfected enough to keep all but such cases from reaching the rear areas. The therapy found effective in the acute cases, and it was from these that the technic was developed, was found effective in the chronic types, but it took longer for the symptoms to disappear and the result in the end did not permit of as high a classification in point of military serviceability as in the cases seen earlier in the hospital's activity.

The first principle of the hospital was to cure the soldier and send him forward. If this were not possible he was to be fitted for military service in the S. O. S., with the hope that he would soon reach the front line status. The very fewest cases were to be sent to the United States; therefore D classification were permitted only in the absolutely hopeless cases, and these chiefly on account of some undercurrent organic malady or previously undiscovered organic lesion of the nervous system. After the armistice was signed, however, the hospital received a great many cases from other places. These were chronic, defective types, etc., representing the unsuccessfully treated residue of hospitals, camps, division back areas, etc. As an offset to this the percentage of higher classification after the armistice increased likewise, so that the balance was maintained and perhaps ran to more cured cases than at any other time in the hospital's history. With the disappearance of war, or rather active fighting, the necessity for the

neuroses disappeared too, or did so largely at any rate. Very few cases of war neuroses developed after November 11 *de novo*, so that the therapeutic problem after that time became much simpler and required much less effort and time. The obstacle to a cure was then the desire to be returned home, a much less forcibly working motive than that of the defense mechanism of self-preservation; it is therefore impossible to test the therapeutic efficiency of the work of this hospital by regarding the percentage of cures, because it has been shown that conditions varied from time to time. First, the acute cases were proportionately high in the early months of the hospital. Second, they ran low during the middle period, and third, after November 11 the war having ceased the hold that a neurosis had on a soldier was much less.

The second general therapeutic principle was that a patient's stay at the hospital was to be as short as possible — the average in the whole hospital was slightly above three weeks. This included the officer material which required long treatment, and also included delays in getting patients out due to transportation difficulties and all other sources of block incident to a hospital operating at the time of active fighting.

The third general therapeutic principle was that all attempts made to cure a patient should be instituted as promptly as possible within forty-eight hours if it could be arranged. Associated with this was the idea, also, that when the attempt was made it should be followed through to a finish at one sitting. This, of course, refers only to the hysterical symptoms.

The fourth principle was that the war neuroses were caused by a mechanism not under the patient's control in its initial phases, but subsequent to that in two to four weeks there might be a contributing factor in the retention of symptoms through the desire or wish of the patient to remain protected by his neurosis. At least this possibility was kept in mind, so that if a cure was not effected within that time the question of the patient's cooperation was brought up.

The fifth principle was that work of some kind was one of the most important aids in effecting symptomatic cures, so that always more than 80 per cent. of the patient's were engaged in work of some sort. This work was of a varied sort, work in the fields in season, road making, wood chopping, and work in a special shop — a therapeutic work-shop carried on by civilian aids. The only novel feature in this was that it was carried on in a hospital to meet war conditions within a comparatively short distance from the front areas.

With the more general and usual methods of treatment of cases of this kind nothing will be said, such as rest for exhausted cases,

ward isolation for excited or markedly tremulous cases, etc. Such things are a necessary part of every hospital, and it will be taken for granted that such methods were carried out as effectively as they could be in a hospital equipped under the handicaps existing in France at that time.

Such methods as presented an individual therapeutic view, were to be found naturally in the hysterias and in the anxiety neuroses, and a description of what was tried out and found of value will be set down, rather to indicate the general trend of therapeutic effort than completely to describe them.

The point in view in hysteria was that the symptoms were the result of a promptly acting shock-dissociation process, either materially or emotionally produced. If in the former it was not in any sense due to definite organic changes in the brain, but to some sort of pre-organic thing, possibly of a molecular or circulatory sort — anything which does not preclude the possibility of an equally prompt restoration to the normal. It was further appreciated that there was a mechanism of fixation of symptoms from which the neurosis tended to develop and become elaborated, so that if the emotionally fixed objective symptom could be removed thoroughly, the rest of the neurosis structure would rapidly disintegrate.

Inasmuch as hysteria was thought of as a mechanism of unconscious origin, coming into activity without the patient's awareness and often without his subsequent knowledge, its symptoms were regarded by the patient as being mysterious and strange. He himself, then, neither understood what they were, why he had them nor what they were due to. The first logical step, therefore, was to attempt to explain to the patient something about the mechanism which had been at work in making of him a hysterical type of war neurosis. The second was to assure him both of its unconsciousness and of the possibility of rapid disappearance provided he gave his cooperation, chiefly by developing a condition of receptivity as far as he was able to do so. The next step was the acquirement of an attitude of expectancy. Then followed the use of the many methods of suggestive symptomatic treatment designed to remove as quickly and thoroughly as possible, symptoms in the order of their importance to the patient. This, in turn, was followed by after-treatment aimed to emphasize the fact that the symptoms had disappeared, and furthermore, to fix the notion of the mechanism originating the symptoms and then to fix the mechanism of their disappearance. The last step was an attempt to so increase automatic inhibition that the symptoms could not reappear. This last was still in process of development when the war ended.

In the phase of explanation only very simple methods were used, depending much on the intelligence and understanding of the patient. With an understanding and belief in a definite mechanistic production of hysteria, it was not difficult to impart such belief to the patient. Without such a belief and knowledge it would have presented great difficulties. The attitude of receptivity and expectancy grew up in the patient's mind either automatically as his belief and faith in his physician took hold of him or arose from his eagerness to get rid of an embarrassing or handicapping group of symptoms. It was possible in many instances to increase the attitude by maneuvers designed to stimulate his desire for treatment. The use of apparent indifference, delay, etc., often caused an increased state of eagerness in the patient to get well. There were developed many devices to increase these essential preparatory qualities to the attack on the symptoms themselves. Some of the staff developed to a high degree, what was called ward morale. This meant the influence of the cured cases and cases cured of a similar set of symptoms, on the individual about to be treated. It also had reference to a rather mysterious thing called ward atmosphere. This was a reflection of the attitude of the nurse, physician and patients to a patient who showed neither aptitude nor inclination to meet the cooperative demands which his case warranted. It is rather difficult to describe in a few words. In certain wards patients were cured quickly and remained so. It was not customary in these wards for patients to show symptoms for more than a little while after their admission. It is of interest that this aspect of ward morale did not simply happen, but was consciously and carefully worked out by the physician and nurse.

The immediate attack on the symptoms was carried out by means of one or more of the suggestive methods everywhere in vogue throughout all the neurological services in all the armies. The suggestive treatment was either intensive — in which case, as a rule, the faradic current was used; or it was gradual — being given at intervals. In some instances the battery was not used at all, persuasion and command, argument and reasoning being all that was required. In other instances again some other material type of suggestion was employed, as tuning forks or stethoscopes in deafness, tongue depressors in aphonias, etc. Whatever method was used, great care was always taken to convince the patient that they were only intensifications of what he was perfectly able to do himself. The faradic current, for instance, used to stimulate a muscle in a case of paralysis was only a means of demonstrating the functional capacity of the muscle, so that the idea of its paralysis, engendered by the process dissociating it for the time being out of consciousness, was negated.

[illegible]

does. Besides this he is apt to be more intelligent; therefore, more suspicious and very much less suggestible than the hysteria. A certain amount of study must be given to past experiences, to his former life, his career in the Army and to the succession of events which brought him into the hospital. It is necessary to acquaint the patient at first hand with the causes that led to the condition, the nature of the condition. He must be instructed as to the nature of conflict, his in particular, and as to the function of repression. Above all, he must be taught to face the whole matter as a section of experience which has come into his life, and which will remain as a part of himself as long as he lives or until the memory of it becomes fainter with the piling up of those of more recent origin.

The therapeutic aim in the anxiety neuroses had formerly been to encourage the patient to forget his experiences and to aid by his own effort the automatic repressive tendency already existing. The new point of view was to attempt to train the patient to face, and to face daily as a matter of course, the experiences he had been through no matter how uncomfortable or terrifying they happen to have been. This, by the way, was not original in this hospital. Charles Myers of Cambridge had carried out this process by means of hypnosis very early in his experience with cases of shell shock, and later Rivers had advised it as a perfectly feasible thing to work out without the use of hypnosis at all. It was in a sense a modified psycho-analytic procedure adapted to a war-born condition, divorced from a good deal of the technical complications of the method used in peace times.

A patient was encouraged to talk about his experiences, to go over the emotional state which accompanied them, and to examine himself as critically as he could in reference to them. It is one thing to face a past event and to measure oneself in the light of that event; it is quite a different thing to try to forget an event and thus allow the criticism, so to say, to go on unconsciously and the resulting emotion to remain as the only conscious evidence of the conflict going on sublimated and beyond reach. The former state of mind was encouraged in the patient, the latter was to be avoided.

The chief conflicts found in the anxiety neuroses were analyzed out in some such manner as this. The technic differed according to the individual therapists. None found it necessary, however, to employ any more complicated technic than that of question and answer or that of a somewhat painstaking history-taking. A perfectly frank account of experiences with the proper narrative sequence of events together with the critical comments of the physician was all that was required in many instances to prepare the way for a successful therapy. The knowledge of such cases acquired by the therapists led to the proper

emphasis of the points he was trying to make, much in the same way that a trained psycho-analyst in the freudian sense indicates to his patient the line of associative events he desires to bring up into active consciousness. In the peace neuroses this is frequently a matter of great difficulty on account of the patient's unwillingness to face the embarrassing nature of the conflict from his point of view. In the war neurosis the conflict is formed out of simpler elements and, since the whole thing is more recent, the repressive function has had much less opportunity to bury them deeply in the lower levels of consciousness. Furthermore, the conflicts were so frequently conventionalized and so often found repeated in different individuals that it was an easy matter to present them to the patient with only a little assistance from him. In this way the rapport between patient and physician was not difficult to establish, because it was found that there was little to conceal and less possibility of deception. The favoring element therapeutically was, of course, the central motive underlying all efforts of treatment, that is, the duty and necessity of fulfilling his obligation as a soldier—the return to duty. Only in exceptional cases was this ever a matter of argument or even of doubt. There could be little weighing of contending motives in such a situation. The duty of a citizen may present many points of conflicting interests, that of a soldier none. That is none, if the point is reached, when he is brought face to face with the definite reality of his military position.

Although the methods of treatment and the general therapeutic attitude toward a patient with anxiety neurosis can be set down in so simple a manner as this, the implication does not follow that the procedure was an easy one or that it was always successful. Such certainly was not the case, for no conditions in the war neuroses were so difficult to handle or required so much effort. Comparatively few men ever acquired the knowledge, patience, tact, insight and firmness to treat such cases adequately. In Base Hospital 117, and no doubt in other places too, there developed among the staff a few men who became in a way anxiety neuroses specialists. The contrast to hysteria in this respect was marked. Almost any one after a little instruction could treat the ordinary hysterical case successfully, whereas only a few ever qualified as good therapists for the anxiety cases.

The therapeutic methods in use in the other types of the war neuroses need scarcely be mentioned in detail in a paper of this kind. Apart from the usual symptomatic treatment, the conventional hospital manner of handling the daily discomforts of a ward full of patients there was little to distinguish this hospital from any other. Drugs were given as seldom as possible, and then only to meet the simple complications of an average patient in a hospital. Bromids,

hypnotics and analgesics were given with the greatest reluctance, and for the most part the patient did better without them. It was necessary at all times to combat the natural desire of a patient for some more tangible evidence of treatment, but this the nurses were for the most part able to do.

Therapeutic use was made of many other agencies not usually mentioned in describing methods of treatment. All of them had to do with strengthening the patient's morale, and forcing on his attention at all times the necessity of getting out of the hospital and back to duty.

The hospital chaplain, Lieut. George Taylor, approached this through wisely and cleverly designed sermons touching on the spiritual phase of courage, loyalty, devotion and patriotism. The sermons and religious exercises were planned in part toward this end, as were the weekly talks by members of the staff and sometimes by visitors to the hospital. In other ways the military atmosphere was kept alive by every means possible. The decorations in the recreation huts were all planned to keep the military atmosphere in the minds of the soldier through stirring posters and scenes of actual war conditions. The walls were covered by sketches drawn for the most part by patients, of men going over the top, artillery going into action, aeroplane fights, etc.

Sympathy in the ordinary meaning of the term had little place in this hospital, intelligent insight and appreciation of the mechanism of the war neuroses in a measure took its place. The military necessity was accentuated and kept constantly in mind, but notwithstanding a certain grimness in the hospital's attitude to its patients, not the slightest suggestion of harshness or severity was ever permitted. The war neuroses were regarded as temporary conditions into which a soldier might fall and thus become a subject for medical treatment. The treatment was bound to fail unless the efforts made to help him met with the cooperation of the patient and a desire on his part to get well. The hospital was planned and equipped for the purpose of returning him to duty and, given his support, did in most cases succeed. If expressing his recent experiences by talking, writing, or even as was done in some cases, by the most lurid drawings was an aid to this end, such efforts were encouraged by whoever might happen to, at the time, be helping on his case, be it *padre*, civilian aid, nurse or some other specially qualified member of the hospital personnel.

The foregoing brief statement on the therapy of the war neuroses is designed merely to point out in a general way some of the principles which were followed. It accentuates what appeared to be the chief characteristic of the specific therapy of the war neuroses which lies in the fact that they are caused by war in the broadest sense of this

term, and that their treatment must always be influenced both by their etiology and the necessity of returning the soldiers so affected to duty as combatants, if possible, or at least to military duty of some kind.

RESULTS

One of the most important aspects of the war neuroses in the American Army was its educational value, both in respect to the added knowledge of the mechanism of the neuroses which resulted from the study of so considerable a material, but also to the education which came to many of the men who were in contact with the problem as it showed itself in the various organizations of the neuropsychiatric service.

For the first time, perhaps, on a considerable scale, the neuroses as a whole were approached as a complete and definite problem, and for the solution of that problem a special organization of personnel, hospitals and equipment were devised. In this way the neuroses became, under war conditions at least, a disease entity capable of the same kind of organized effort that has met with such great success in the problems presented by tuberculosis and certain of the infectious diseases.

It was planned to include in this paper a statistical résumé of the 3,000 odd cases which passed through Base 117, and the 1,500 cases studied in the shell shock wards at Base 12, the general hospital at Rouen. This can not be done here because the records of these cases have been delayed in transit.

In a general way it may be stated that about 65 per cent. of these patients were returned to the class of active duty; that is, either to front line work or to camps or stations preparatory to this. About 30 per cent. were sent to S. O. S. duty and the remainder were included in the class totally unfit for military duty of any kind. In this last class in the early history of Base 117 there were no instances of war neuroses, but only such cases of organic nervous disease and mentally deficient individuals who had been sent there unrecognized or wrongly diagnosed. In the forward neurological stations the percentage of returned cases was much larger, and in the *triages* larger still. This means, of course, that the prompt treatment of incipient cases at the hands of experienced men can prevent in many instances the full development of the neuroses in a fixed form.

CONCLUSION

In concluding a paper of this kind, which after all is an attempt to concentrate in a brief space an experience of many months and of a large material, something must be said in regard to the success and value of the efforts made to solve so perplexing and intricate a problem.

Did the neuropsychiatric organization of the A. E. F. handle the war neurosis problem in such a way that it ceased to be a factor of weakness in the building up of the military efficiency of the Army?

In answering this it is obvious that purely medical factors cannot by themselves furnish the necessary data. Its efficiency cannot be determined by the consideration of medical achievements only, and no amount of medical research arising out of the study of these cases can balance a lack of success in satisfying the military necessity of keeping as many men as possible on an active duty status. The test of the organization's efficiency is to be measured in terms of military utility, analogous to the test applied to an anti-tuberculosis campaign, for example, in terms of economic efficiency. It is as if the success or failure of an attempt to counteract the effects of tuberculosis in a given community should be measured in terms of the percentage of total or inefficient employment in that community, or measured in terms of economic loss in that community.

In some such way as this the military value of the neuropsychiatric organization has to be tested and, unless it meets this test—supported by the military authorities—it must be considered a failure. The following questions, therefore, have to be answered before judgment can be rendered: (1) Were the war neuroses handled in such a way that they did not become numerous enough to disproportionately burden hospital transportation and supplies? (2) Were those patients treated efficiently enough to permit a fair percentage of those afflicted to be returned to military service? (3) Was there a steadily decreasing number of men with war neuroses received in the back areas as the result of more effective screening at the front? (4) Were the individual soldier, medical officer and line officer more informed and better instructed on the subject of the war neuroses as the participation of the A. E. F. in actual fighting became more extensive?

It is a difficult matter to answer these questions without qualification and without reference to statistics. The latter cannot be made use of here on account of incomplete data, and the former would require too much space. There are so many factors apart from organization and medical matters that it is confusing in determining to which of these may be due the definite fact that, as the fighting on the Western front progressed and as the American participation became more and more developed, the proportion of war neuroses to the total casualties showed a progressively smaller percentage. At the same time the percentage of returned cases from the *triages* and the forward neurological stations became fixed within the definite percentage limits—from 70 to 80 per cent. Furthermore, the screening was so effective that only the severest types of the neuroses

reached the base hospitals and rear areas. At the time of the armistice the organization had reached this stage of efficiency. From then on the war neuroses problem was no longer concerned with active fighting conditions, but had to do with the attempt to return soldiers to their divisions in the Army of occupation or to the other areas of military activity of a noncombatant nature.

By the test then of organization efficiency as indicated by the answer to these questions, the plan and method of dealing with the war neuroses developed in the A. E. F. might be said to have shown all the indications of elasticity, adjustability and workability. As a result the war neuroses ceased to be a problem of military importance in the A. E. F. That is, the number of cases, the proportionate representation of such cases in the total casualties, the percentage of returnable cases, placed the war neuroses among the casualties of lesser importance.

There is a less definite answer to the question of the solution of it as an after-war problem. How great this problem is destined to be is of course at the present time in doubt. This doubt is not due to what was done abroad, but what might be done or what is to be avoided in the United States. The proper place to treat war neuroses is undoubtedly at the place where soldiers are being trained, and within the influence and atmosphere of combatant troops. When these influences are removed probably the most important therapeutic agent is also taken away. The methods found effective in France would, with some modifications perhaps, be found effective at home. If they are not followed no standard of fair comparison exists and the two problems must be considered apart and as essentially different.

The essential thing in this aspect of the problem is after all the number of cases which were sent over as uncured or with a hopeless outlook from the viewpoint of military utility. If this number is a relatively small one in proportion to the total number of cases, it represents a residual well within the limits of the normal military deficiencies. The method of handling this residue then depends on a point of view expressing an experience gained in actual contact with cases of real war neuroses or one based on a theoretical conception of the war neuroses from a pre-war basis. The outcome of such differing points of view remains a matter for future testing.

It would seem that, if the number of cases is relatively small, special hospitals or a special organization are no longer necessary, so that patients can be returned to their civil status as soon as possible and receive such treatment and advice as is necessary at the hands of already established neurological clinics or in neurological services in hospitals. In this way the problem becomes a part of the problem

of handling the neuroses in any community, and the fact that the qualifying term—"war"—is dropped from the designation of their malady is of definite therapeutic benefit.

A more definite answer to the last of these questions can be given when a statistical and analytical study of the total material of war neuroses is made, with especial reference to the ultimate fate of the 3,000 cases seen at Base 117, and particularly those returned as Class D to the United States. This work will be taken up in a future publication.

The medical gain from the experience embodied in the war neuroses has been very great. The increase in knowledge of the neuroses due to the enormous number of acute cases studied by a large number of neurologists under all kinds of varying conditions is large enough to warrant a complete shifting of our previous point of view. There is nothing national or characteristically American in this aspect of the question. For a period of over four years the leading neurologists of the world as a whole have been engaged in studying the reaction of the nervous system to acute and unusual traumas. A certain proportion of such traumas have shown effects on the nervous system of a definite anatomic character, a much greater proportion have shown no such effect, but the reactions have been modifications of physiologic-responses, functional adjustments, which under the picture of symptoms are called neuroses. These, then, form the material on which so much effort, energy, enthusiasm and insight have been focussed. Out of this has come certain facts, many theories and points of view.

From this also, perhaps of equal value, has developed an interest among all medical men in the subject of what was called functional nervous diseases. This cannot help from having important consequences for the future. The war has given an impetus to the recognition of the facts that conditions of this kind have definite reasons for existing, are the results of definite mechanisms, and are curable if both these facts are understood and appreciated. In the war there was provided a well understood etiology capable of being individually analyzed, a series of reactions repeated in sufficiently large numbers to form recognizable types and a therapy planned to meet individual requirements. Thus the clinical sequence was complete.

To attempt to summarize in a catagorical fashion a paper of this kind would serve no purpose, but certain selected tentative conclusions may be set down as indicating the point of view embodied in the paper. They are intended to suggest ways of thinking about the war neuroses rather than to express definite theories or facts, and in this spirit it is hoped they will be considered.

1. The organization and development of the neuropsychiatric department of the A. E. F. led to the formulation of a characteristic point of view in regard to the war neuroses. This point of view had a definite influence on the entire medical and military personnel in contact with the soldier suffering from the war neurosis.

2. The war neuroses are clinical entities with clinical expressions of a sufficiently definite kind to warrant type classification.

3. The varying clinical picture is due not so much to the kind of thing that happens or to the effect of what has happened, but to the reaction of the individual in the process of adjustment to the things that have happened to him.

4. The war neuroses are the products of definitely working sets of mechanisms, physiologically activated which show themselves by means of psychogenic adaptations.

5. The war neuroses are protective or defensive elaborations of the primary instinct of self-preservation in the face of destructive incidents of war.

6. For their production a certain degree of lessened normal inhibition is necessary. This is most easily produced through the effect of shell explosion by which a brief or longer period of unconsciousness, stupor or confusion results.

7. It is in this period that by the process of fixation the initial symptoms are manifested. These often are automatic repetitions of reflex defensive maneuvers.

8. The degree of lessened inhibition may be produced by a trauma which acts for the most part emotionally.

9. In the earlier phases of the development of a war neurosis volition has no place; later at the period of convalescent conflict, a varying degree of volition and wish may be present.

10. Exhaustion, fatigue sleeplessness, responsibility, hunger and thirst are important indirect factors in preparing the soil for the development of a war neurosis. The immediate factor is some sudden or unusual trauma associated with an intense degree of emotion.

11. War neuroses are not the result primarily of an organic change in the structure of the nervous system. They do not develop in the presence of serious lesions of the brain, and they are not necessary to the individual in the presence of severe wounds.

No paper on the war neuroses should be completed without directing attention to the possibility and necessity of striving in every way to translate into the problems presented by civilian neuroses the knowledge, insight and experience gained in the war. If this is not done the war neuroses are no more than an evanescent item in the casualty lists. The war neuroses are specific war-born conditions, and with the end-

ing of the war they disappear from clinical experience. Their place is taken by the civilian neuroses which are different things.

What remains are the mechanisms and therapeutic methods. These are the unchanging elements and understanding them is the permanent gain. All that is necessary is to replace the conflict of battle by the conflicts which result from social and economic stresses; to substitute less fundamental instincts for that of self-preservation, and to cultivate in treatment the same therapeutic eagerness, definiteness and incisiveness which were found effective there. If this is done the "return-to-duty" cases in the civilian neuroses will reach and pass beyond that which was possible among the soldiers who were treated in the various divisions of the neuropsychiatric organization of the A. E. F.

If it has been possible in this paper to suggest something of the opportunity for study which this material furnished, something of the spirit with which the problem of the war neuroses was approached, and something of the promise which should result from experiences of this kind to the future of American neurology, its purpose has been largely fulfilled.

Abstracts from Current Literature

EPIDEMIC ENCEPHALITIS. ARTHUR J. HALL, M.D., Brit. M. J., p. 461 (Oct. 26), 1918.

The author reports his observation of sixteen undoubted cases of an epidemic of encephalitis which appeared in England in 1918. These cases include persons of each decade of life to the 70th year; only two were under 10 years of age. The sexes were about equally represented. In time, the epidemic extended from March and was practically over by the end of May. The clinical features are as follows:

Mode of Onset: The onset varied considerably. In most cases the date of onset could be fixed quite easily. In five the onset was sudden; in the remainder it may be described as gradual.

Signs and Symptoms: The three cardinal symptoms in a typical case are (1) lethargy; (2) general asthenia, and (3) cranial nerve palsies, the main features being the asthenia and the lethargy. Hall describes the attitude of the patient in bed as suggestive of an effigy on a tomb. The mask-like appearance of the face is increased, where there is a facial diaplegia. A definite facial palsy is not necessary to produce this appearance. One or even two of the three cardinal signs may be slight or absent. The actual cranial palsies are often slight and limited to an inconspicuous ophthalmoplegia.

The Prodromal Period: In most cases there is a distinct interval between the onset of the illness and the appearance of the characteristic symptoms. This interval varies widely, usually only a few days. Often neuralgia is complained of, vertigo and tinnitus, stiffness of the face, drowsiness, delirium and a slight rise in temperature. After the onset, the development of the symptoms is usually ingravescent. Ophthalmoplegia, producing a various degree of strabismus, inequality of the pupils and nystagmus, was commonly present, the last mentioned was sometimes of an irregular, incoordinate kind. Fever was noted in many cases, possibly it was present in all.

Lethargy, the most striking feature, was not a true sleep; often the patient was surprisingly awake to what was going on. Many patients were stuporous all day but became delirious at night. The delirium often suggested hysteria. Tremors with asthenia were among the chief symptoms; the asthenia and the appearance of the face, together with the tremor, suggested the syndrome of paralysis agitans.

Results: Complete recovery in seven cases. Practically complete recovery with some slight trace of illness left behind in six cases. Incomplete recovery in three cases.

Bringing his observations to conclusion, Hall raises the fundamental question, namely, is this or is it not an epidemic of poliomyelitis? If it is not poliomyelitis, it may be either an entirely new disease or one that up to recent times has not been observed in an epidemic form. He calls attention to the absence of limb paralysis commonly seen in acute poliomyelitis and is inclined to agree with the clinical differences more recently established by Kinnier Wilson. He makes the statement that lethargy and asthenia so severe and prolonged in most cases of encephalitis are not recorded as occur-

ring in typical cases of poliomyelitis, either sporadic or epidemic. He does not believe that the term "sleeping sickness" could ever be used in connection with poliomyelitis, and yet it would not be an inappropriate name for this present epidemic. The onset in poliomyelitis tends to be rapid and maximal, whereas in epidemic encephalitis it is often gradual and ingravescent in type.

Many nerve poisons, such as diphtheria, *B. botulinus*, lead, alcohol, etc., show a peculiar predilection to certain particular parts of the nervous system. In these cases of epidemic encephalitis there seems to be such a definitely selective action at work. Poliomyelitis is commonly held to be essentially a cord disease in its sporadic form, while in its epidemic form it is characterized by the multiformity of sites affected. This line of argument rather accentuates the clinical difference between poliomyelitis and the cases of the present epidemic. As regards the possibility of this being an old disease and its presence being more distinctly recognized in epidemics, Hall refers to the older references in the literature already mentioned by Kinnier Wilson. He is of the final opinion that the ultimate nature of the disease must be disclosed by the pathologist.

TILNEY, New York.

"AKRODYSTONIE" ALS VOLGEZUSTAND VON KRIEGSVERLETZUNGEN DER OBERN EXTREMITÄTEN. ROBERT BING, Schweiz. Arch. f. Neurol. u. Psychiat. **11**: No. 1, 1918.

Bing reports two cases with peculiar contractions of the hand which do not fit into any of the familiar, classic types observed in injuries of the ulnar, median or musculo-spiral, or combination of injuries to those nerves. In both cases the hand was either straight or slightly dorso-flexed at the wrist, the metacarpo-phalangeal joints flexed, all the phalanges were flexed and the thumb strongly flexed and adducted, with marked overaction of the opponens pollicis. The fingers were closely adducted. Peculiar, unconscious, chorea-like flexion movements, which did not disappear during sleep, were observed. The contraction could be more or less actively overcome, though with great difficulty and effort, but passively it could be entirely reduced, only to be followed by a quick return to its former position. The grip was weakened in that the middle and proximal phalanges did not contract well. In Case 1 the patient could not immediately loosen his grip on command—a phenomenon similar to that observed in myotonia. The electrical reactions were: (1) galvanic hyperirritability of the muscles involved; (2) diminished direct muscular (?) faradic irritability; (3) undisturbed irritability of the nerves (ulnar and median) either faradic or galvanic, and (4) normal electrical formula—KCC>ACC. In Case 1 the extensor communis digitorum showed RD.

Case 1 gave a history of a bullet wound received in the elbow on May 27, 1915. The contraction followed immediately after the injury. In February, 1917, the patient came under Bing's care, but no reliable history of previous interference could be obtained. A new operation was undertaken at which a neuroma was found in the ramus profundus nervi radialis (supplying ext. com. digit.) and the median and ulnar were embedded in a cicatrix. The nerves were freed and protected by embedding in fatty tissue. Case 11 gave a history of a shrapnel wound in the forearm, just below the elbow. The patient had had four operations, none of which he could describe. Immediately following the last one the contraction set in. This patient suffered from severe hyperesthesia of the operative scar, as severe as in cases with traumatic neuroma. At operation the median alone was seen to lie in the field, but

thorough search showed it to be uninjured. The painful scar was excised. Following the operations the contractions gradually and to a great extent disappeared in both cases and the movements ceased.

Bing explains this condition on the principle of a disturbance in the tonus equilibrium of the muscles. He sees in this a purely symptomatic dystonic condition, and because it happened in the extremity he calls it *traumatic acrodystonia*. As the tonus of the extremities is maintained by the afferent path of the reflex arc, he thinks that the cases were the result of a disturbance in the centripetal stimuli, which conditioned a constant, stereotyped hypertonia of the ulnar and median. He believes that the cases belong to the group which the French (Babinski, Marie, Froment, Foix) call "*Contracturee et paralysies traumatiques d'ordre réflexe*"; and he says that they are to be distinguished from hysterical contractions or those following actual injury of the nerve. It seems to the reviewer that Bing has not made his diagnostic differentiation very clear. The pictures he gave remind one a good deal of the "*syndrome of irritation*" described by Tinel. The rather sudden onsets point to a strong functional element. It is to be regretted that the author does not mention objective sensation.

As frequent accompaniments of reflex anomalies Bing mentions: (1) Local hyperthermia, which his cases showed, and Case 1 also hyperhidrosis; (2) strong vasomotor disturbances, which occurred only in Case 1, and (3) increase of the contraction during anesthesia and sleep, which is explained by the freeing of the spinal reflex from upper neuron control. His cases showed increased contraction during sleep, but not having received general anesthesia he could not confirm the other point mentioned by the French observers. The same authors also speak of "*atrophie globale, laxité speciale des ligaments, aspects des jointures rappelant le rhumatisme*," but Bing did not observe them. Babinski also speaks only of quantitative electrical changes, whereas Bing found some faradic-galvanic dissociation. While in Case 1 the flexor contraction may have been aided by the paralysis of the extensor communis digitorum, in the second case there was no such cause, and yet the contraction was even greater. The French have described reflex paralyses and contractions conditioned by hypertonia, particularly in the realm of the median and ulnar, and some have even reported them in the muscles of mastication. Bing says that thus far little attention has been given to operative treatment in those cases. Seeing the good results in his own cases he recommends it for further trial.

WECHSLER, New York.

A REPORT OF GOITER AMONG DRAFT MEN FROM THE NORTH-WEST. CAPT. FRANK P. BRENDEN, M. C., and FIRST LIEUT. H. M. HELM, M. C., Fort McDowell, Calif., Arch. Int. Med. 23:61 (Jan.) 1919.

Examination at this camp of the May and June contingents revealed a "remarkable number of thyroid enlargements." Many cases were unassociated with toxic symptoms. A considerable proportion had true hyperthyroidism. The results of these observations are given (chiefly) in tabulated form:

Case number; family history (that is, presence of enlarged thyroid only); geographical origin; size of thyroid; tremor of hands; eye findings as positive or negative for Stellwag's, von Graefe and Moebius signs and exophthalmos; heart findings, tachycardia, at rest, immediately after exercise, two minutes after; blood pressure; urinalysis, albumin, hyaline casts, granular casts.

The authors' conclusions, based on the study of 9,851 men from the nine states west of and inclusive of the New Mexico, Utah, Montana line are as follows:

1. Goiter is more common in young men than the experience of the general practitioner would suggest.
2. There are definite goiter districts in Oregon, Montana, and probably in Nevada.
3. Locality appears to be of much greater importance than family tendency.
4. Many goiters in draft men are unmistakably toxic.
5. Many toxic cases show tendency to nephritis.
6. All men having thyroid enlargement should be examined for cardiorenal pathology.

DEADY, New York.

ANALYSIS OF A CASE OF MANIC-DEPRESSIVE PSYCHOSIS
SHOWING WELL-MARKED REGRESSIVE STAGES. LUCILE DOOLEY,
Psychoanal. Rev., January, 1919.

This paper is of unusual interest and value from three standpoints. It gives a graphic account of the life history and psychosis of a patient with that touch of the dramatic which is as necessary to psychiatry as to novel writing. We have a careful description of an atypical psychosis with recovery which is a rarity. Finally the psychologic analysis is convincing and reproduced with sufficient detail to be instructive.

An intelligible digest of this contribution would extend almost to the limit of this paper itself to which the reader is therefore strongly recommended to refer. As a mere catalogue of data presented it may be stated that we are told of a girl born of unstable stock, reared in a difficult family environment whose inferiority feeling led to social maladaptation. A stifled sex curiosity developed into perverted thoughts and masturbation, which in turn caused her sense of inferiority to become crystallized around sex complexes. There were many fully conscious ruminations on these topics. Jealousy of her sister led to a gastric neurosis, a compromise with reality which failed to solve the problem whereupon she gave up her academic life. A curettage precipitated delusions, during which suicidal (?) attempts were made and later an inadequate precipitating cause led to a manic attack at the age of 21. She then came under the writer's observation, who followed six monthly attacks, after which an excellent recovery seems to have resulted. Excitement began with euphoria two weeks before menstruation. For two or three days she regressed to her adolescence and was full of solutions of her problems. Then conduct disorders appeared which seemed to represent return to childhood. Next her behavior was full of infantile characteristics including much untidiness, even going to the extent of koprophilic indulgence. She became inactive, had persecutory ideas and was irritable for a few days, after which there was depression with painful insight into her previous abnormality. Psychological discussions of her difficulties were undertaken during these latter periods.

Psycho-analytically, the content recorded and history recovered is of unusual interest. Many well known and a number of less notorious symbolismisms are reported. Two features are important. The author found ample confirmations of Burrow's theory of homosexual tendencies resulting from mother-

body-identification via narcissism. Secondly, Jung's "constructive unconscious" was prominent both in the productions of the psychosis and in the psychoanalysis. To what extent the latter served to establish a workable adaptation or how much this was the spontaneous sequel to ventilation of buried complexes is naturally a topic for unfruitful speculation or prejudiced discussion. It is only the accumulated and collected results of open-minded work such as this which can furnish us with an answer.

The question of diagnosis is intriguing. "As the psychosis progressed, the manic symptoms came more and more to the front—so that the final diagnosis agreed upon was that of manic-depressive psychosis, determined by the patient's distractibility, the flight of activity, the absence of stereotypy, the periodicity of the attacks, the manifestly extroverted type of personality, and—but this is now of very questionable diagnostic value—the complete recovery." Naturally the obvious manic traits favor such a diagnosis. On the other hand, one doubts "the manifestly extroverted type of personality" when reading over the history. Further, the occurrence of infantile sexual material makes one suspicious. One would like to have the record show more clearly just what the affective setting of each delusion or production was. Occasionally, too, one feels a little doubt as to whether some idea is given in its actual psychotic form or whether it has been expanded by analysis. The reviewer is quoted as having shown that the archaic type of reaction may occur in manic cases. As a matter of fact the paper quoted makes no attempt at diagnosis, the title being merely descriptive—"Manic-Like." (The case was indubitably dementia praecox and recognized as such.) The fact of recovery cannot be taken as conclusive, as the author admits. If the chronicity of dementia praecox be looked on as a faulty habit reaction, there is no theoretic reason for doubting the possibility of reeducating a very early case before the infantile tendencies have become habitual, precluding more adaptive satisfactions. At least, we may hazard the guess, that without the alert intelligence with which she was observed and the analytic guidance which dominated her treatment, the case here reported would have either slipped into a chronic psychosis or have had a much more prolonged attack than that from which she suffered.

MACCURDY, New York.

CERTAIN PLURIGLANDULAR ANOMALOUS FUNCTIONS ASSOCIATED WITH PSYCHOPATHIC SEXUAL INTERESTS. MARY O'MALLEY, *J. Nerv. & Ment. Dis.* 48:1 (July) 1918.

O'Malley describes the cases of eleven women from the wards of the Government Hospital for the Insane in which she found anomalous functioning of endocrine glands and associated with it psychopathic sexual interests. They were cases chiefly of schizophrenic and manic-depressive reactions. They presented a pseudohermaphroditism manifested in the secondary sex characteristics. *Physically* the cases were characterized (the article is fully illustrated) (1) by a male habitus, but with small delicate well-formed hands and tapering fingers; (2) by obesity which was present either since infancy, childhood, or adolescence; (3) by hypertrichosis with male distribution (beard and mustache, chest, etc.) and male outline of pubic hair, and (4) disturbances of menstruation. The *mental* characteristics are said to be a disturbance in the psychosexual development. Some of the cases showed overt homosexuality. Of considerable interest is a statement made that in three cases with manic-depressive reaction the patients showed homosexual tendencies in the depressed and normal period, while they showed heterosexual tendencies in

the excited phase. Unfortunately the paper does not give the facts on which these conclusions are based so that an independent judgment is not possible; in fact, one case is from this point of view quite confusing. The author makes a definite statement that the patient is heterosexual in her excitement. Now manic cases usually show a heterosexual content of the psychosis and we are not surprised at this, but we are at the same time told that in the excitement the patient gives full expression to the content of her unconscious. Of this expression a few snatches are given to the effect that the patient claimed to be a man, felt like a man, etc., utterances which of course are not exactly qualified to prove that this patient is heterosexual during her excitement, and one wonders how well founded the assumption is of homosexual tendencies in the depressive phase.

Hoch, Montecito, Calif.

CONSIDERATIONS GÉNÉRALES SUR LA CAMPTOCORMIE. (GENERAL CONSIDERATIONS ON CAMPTOCORMIA.) SALOFF ROSANOFF, *Nouv. Iconog de la Salpêtrière*, 28:28, No. 1, 1916-1917.

Camptocormia, derived from two Greek words meaning flex or bend the trunk (*καμπτο-κορμος*) is a term devised by Souques for functional curvatures of the trunk, often noted in soldiers who have seen active warfare. The trunk of these patients is flexed forward with or without associated bending to the side. Roentgenographic examination shows no lesion of or near the bone, and the free mobility of the vertebral column precludes the possibility of an existing cord lesion. In sixteen thoroughly investigated cases, no organic lesion could be discovered, showing that from the clinical standpoint these attitudes are purely functional. Etiologically, these cases can be divided into two groups: (1) Soldiers having a war wound or injury of some kind, and (2) soldiers free from any external wound. The first variety is very rare and in the author's clinical material was represented by only two cases, in which the wounds were, moreover, remote from the center of flexion. The second group is much more numerous, none of the fourteen patients having been actually injured in any way. The majority were soldiers who had been in the close proximity of bursting shells and who had been buried under the earth and debris or been propelled by the flying projectile and jolted in the dorso-lumbar region. The traumatism was followed by more or less prolonged loss of consciousness. In some instances, hematemesis and hemoptysis were noted, as well as transitory urinary disturbances, in the form of retention requiring repeated catheterization. Locally, according to the patients' statements, only lumbar ecchymoses were demonstrable, without sprains or fracture. In all these cases, lumbar pain was the predominant and constant symptom, manifesting itself from the start and subsiding very gradually in the course of several months. The pain was severe, continuous and aggravated by the slightest movement; it was situated at the level of the dorso-lumbar region affecting the lumbar muscles and was sometimes prolonged anteriorly in segmental form or descended to the lower limbs. After having been evacuated from the front toward the rear, the patients remained during several weeks in the recumbent position. From the viewpoint of the pathogenesis, it is noteworthy that the only position in which they felt some relief and which they were forced to maintain for some time, was one with the head placed between the lower extremities; the least movement or change of position caused intolerable pains. At the end of two or three weeks, the pain became less severe, and on trying to get up, the patients discovered

that they were "bent double" and were no longer able to resume the upright posture. From this time on, the attitude remained unchanged despite the most variegated treatment (glowing cautery, massage, electrotherapy and mechano-therapeutics, etc.).

As to the pathogenesis of these camptocormia affections, it seems likely that during the lengthy, painful period while the patients remain "bent double," the immobilized muscles adapt themselves to a certain more or less comfortable position, thus rendering stationary the muscular contraction as well as the attitude. The persistence of these attitudes is referable to a considerable extent to the peculiar psychology of the bearers of these camptocormias, who are all more or less neuropathic individuals. In normal persons with an active will-power, muscular immobility, even when prolonged, is not likely to create fixed attitudes. whereas in neuropaths a so-called "functional" secondary symptom easily assumes a preponderating place and is apt to persist even after the disappearance of its cause, through a certain inertia, a kind of habit, or by auto-suggestion. The prognosis of these affections depends essentially on this psychological factor.

As symptomatic treatment, the plaster corset recommended by Souques seems to be the best measure for restoration and suggestion. It may be applied without general anesthesia in those cases where the patient can be spontaneously straightened out on a horizontal plane. The treatment is advantageously combined with strict disciplinary measures during the time the corset is being worn (from eight to ten to fifteen days). The patient must be assured of the efficiency and reliability of this treatment. It is advisable for the physician in person to remove the plaster corset, to insist on the certainty of the cure, and to surround the patient with an atmosphere of suggestion. This therapy has proved successful in all the reported cases.

GOODHART, New York.

SOME OBSERVATIONS ON THE RELATIONSHIP BETWEEN SYPHILIS OF THE NERVOUS SYSTEM AND THE PSYCHOSES LAWSON G. LOWREY, *Am. J. Insan.* 74:25, No. 1 (July) 1917.

Plaut has called attention to certain hallucinatory states associated with neurosyphilis, the latter demonstrable serologically and neurologically. In these cases nothing in the clinical picture points to general paralysis. These cases are not very uncommon and the reviewer has seen a number of them. The internal relationship between these hallucinoses and neurosyphilis can scarcely be questioned. On the other hand, we now and then see a dementia praecox picture associated with neurologic or serologic (or both) findings of neurosyphilis. Then it is difficult to say whether we have an internal relationship or just an accidental combination. The first possibility, however, should not a priori be excluded and cases are needed which show at least a common beginning of the neurologic or serologic findings and the psychosis.

The paper here reviewed contains a report of various types of psychoses which are ordinarily not associated with neurosyphilis. We shall confine our review to some cases which Lowrey calls dementia praecox and which represent some material germane to the problems just raised by the reviewer.

CASE 1.—A man admitted in 1908 at the age of 37. At 26 he developed auditory hallucinations with delusions of persecution especially directed against his sister. He improved in a private hospital, but after being dis-

charged seven years later showed again the same symptoms. He remained throughout in good contact with the environment and was industrious, but continued to have hallucinations and delusions. He showed no neurologic signs on admission in 1908, but in 1916 a serologic investigation revealed all the findings of general paralysis. At that time the neurologic findings were again negative with the exception of the fact that the pupils reacted only "fairly well" to direct and consensual light, and that he had a slight tremor of fingers and facial muscles. Lowrey is of the opinion that probably the neurosyphilis did not exist at the beginning of the psychosis. Nevertheless the date of infection is not known and the reviewer feels that the case might belong to the Plaut group. The same remarks apply to Case 3 who was a man admitted in 1893, aged 32. In 1911 he developed hallucinations of smell and hearing and delusions of poisoning which improved, but later again he had ideas of persecution about unions. All this finally settled to a hallucinosis with a certain suspiciousness. About this case it is known that in 1911, that is, at the beginning of the psychosis, no neurologic findings were observed at the Psychopathic Hospital, nor were any observed in 1913. In the latter year, however, he had a positive Wassermann reaction in blood and fluid, a globulin excess, and 90 cells, and these findings were still present in 1916.

CASE 2.—This was a woman admitted in 1909, aged 22. A short time before admission she became violent. At the hospital she was at first indifferent, stupid, and presented meaningless laughter. Later she developed a negativistic catatonic state. Neurologically the pupils showed on admission inadequate reaction to light, and later she developed blindness (no ophthalmoscopic examination). Serologically there were found, in 1915, the typical findings of general paralysis. We must agree with Lowrey that on account of the early pupil changes the neurosyphilis probably existed from the first.

CASE 4.—A man admitted March, 1915, aged 27. At 22 he had "gonorrhea and chancre (?)." When 26 he had ideas of being watched, followed, hypnotized, also ideas of thought reading, and he heard voices calling him names. After admission the same symptoms persisted. Neurologically he was negative. On lumbar puncture there was evidence of a low grade syphilitic infection. Intradural injections of mercurialized serum improved the laboratory findings, but the injections had to be given up and the case was lost sight of.

Hoch, Montecito, Calif.

THE TREATMENT OF DEMENTIA PRAECOX BY PSYCHOANALYSIS. A PRELIMINARY REPORT. ISADOR H. CORIAT, J. Abnorm. Psych. 12: No. 5, Dec., 1917.

The title of this paper is, perhaps, a little misleading, for of the five cases cited only one seems to have indubitable symptoms of a definite dementia praecox psychosis. It would have been more accurate, perhaps, to say "Treatment of Seclusive Tendencies (or, Dementia Praecox Personality)."

Of the first cases, two recovered and the other three showed improvement. As practically no details, either clinical or analytic, are given, there is little instruction in the paper. The author makes good his claim, however, that cases should be treated early and the publication is justified if only as an encouragement to other workers.

MacCurdy, New York.

DIE VORDERHIRNGANGLIEN. With Four Illustrations. Prof. Dr. E. LANDAU, Bern, Schweiz. Arch. f. Neurol. u. Psychiat. **111**: No. 1, 1918

Since it is a matter of dispute whether the caudate and lenticular nuclei and the amygdaloid nucleus and claustrum belong to one group or whether the last two form part of the cortex, Landau set out to solve the problem for himself. To this end he studied the literature and made sections of the brain which he studied by the Weigert-Pal method.

Monakow thinks that all four belong together, that there are bridges of gray matter between the lenticular and the amygdaloid nucleus, but mainly between the lenticular and caudate and amygdaloid and claustrum. Ziegler agrees with this. Brodmann is of the opinion that the claustrum is merely an inner layer of the insular cortex, and according to Wernicke the putamen also is a derivative of the cortex. Even the amygdaloid nucleus is said to belong to the cortex, that is, to the heterogeneous cortex formation of the archipallium, particularly the pedunculus olfactorius, tuberculum olfactor., and substantia perforans anterior. Voelsch and to some extent Elliot Smith concur in this view. With reference to the claustrum, Wernicke thinks that it forms part of the insular cortex because it contains exquisite spindle-shaped cells; but Luys interprets this differently—"L'avant-mur qui paraît de même nature que celle du corps strié." De Vries denies on embryologic grounds the connection between the claustrum and insular cortex. As to comparative anatomy, M. Holl points out that in carnivora and ungulates the claustrum extends across the fissura rhinnica into the lateral area of the rhinencephalon, and since in animals the fissura is the boundary line between the island of Rheil and the rhinencephalon, one cannot say that the thinned out claustrum is basal insular cortex. Winkler and Potter agree with this.

In sections through the island of Rheil one does not find a continuous claustrum throughout; here and there it is interrupted by strong bundles of the fasciculus uncinatus. In horizontal sections, at the level of the ganglion habenulae, one gets the impression that the claustrum belongs to the insula, as here the external capsule is very thin and the narrow claustrum hugs the isle. But at the level where a section cuts through the corpora geniculata, nucleus ruber, commissura anterior and ansa peduncularis, the claustrum is broad, and, what is more important, it is interrupted in its middle part by the fasciculus uncinatus, so that at this level there is no claustrum on the inner part of the true isle. As it seems altogether unlikely that a foreign system of association fibers will suddenly plunge in between the separate layers of the insular cortex, Landau disagrees with the Wernicke-Brodmann view. However, one can prove ontogenetically that there is a connection between the claustrum on one side and the amygdaloid nucleus and the substantia perforans anterior on the other. One can see this intimate connection between the amygdala and claustrum if one makes a sagittal section through the amygdala, cornu ammonis and putamen. More instructive are frontal sections which anteriorly show the tendency of the claustrum to veer toward the substantia perforans anterior and further back the gray substance is seen to go to the amygdaloid nucleus.

Phylogenetically the amygdaloid nucleus is very old, Edinger having studied it in the goose. Ariens Kappers and de Lange conclude as follows: The controversy whether the amygdala of mammals is of striatal or cortical nature finds its solution in that originally (phylogenetically) it undoubtedly is striatal although it has secondary cortical connections, particularly with the paleo-

cortex. One cannot say that the amygdala comes from the temporal lobe since in rodents (not to speak of birds) there is an amygdala and no temporal lobe as yet. Based on his own sections Landau definitely states that the amygdala has connections by means of gray matter with the claustrum, nucleus caudatus, nucleus lentiformis, formatio ammonis and, last but not least, the substantia perforans anterior. He cannot say anything of the fibers of the claustrum, but he can about those of the amygdala: Some fine bundles go to (or from) the substantia perforans anterior, other thick bundles from the posterior part of the amygdala, lying laterally, go to the tractus opticus and belong to the stria terminalis (tenia semicircularis) and, finally, fibers of medium thickness probably belong to the tract, temporo-thalamicus, which was carefully described by Dejerine.

[Conclusion: In view of ontogenetic, embryologic and comparative anatomical studies one must look on the claustrum and amygdala as structures of noncortical origin, and in the conception of basal ganglia one must include them with the lenticular and caudate.]

WECHSLER, New York.

THE CEREBELLAR GAIT: A PEDEGRAPHIC STUDY. I. LEON MEYERS, M.D., *J. Nerv. & Ment. Dis.* 49:14 (Jan.) 1919.

The author objects to the term cerebellar ataxia on the ground that it tells us nothing either as to the particular type of movement that is affected or as to the disturbance in the relationship of one movement to another, which is normally required in carrying out locomotion. His experiments were devoted to the dissociation of the general function of locomotion into its component parts so as to study them individually.

The graphic method of Marey—the registration of the movements of the limbs, communicated by air transmission from tambours attached to the limbs to recording tambours the writing levers of which record on a moving drum—was modified for use on dogs. The rubber air chamber attached to each foot was compressed when the foot rested on the floor, and expanded when the foot was in the air. The recording tambour registered these compressions and expansions and thus gave graphic evidence of the time relations of each component of the step. In a normal dog there is a rise in the curve as the foot strikes the ground, and, particularly in the case of the hind limbs, a further sudden rise may occur, beginning at about the middle of the period during which the foot is on the ground. This second rise is due to an intensified contraction of the extensors, through which the pressure of the foot on the ground is increased beyond that due to the body weight. Frequently the rise occurring when the body strikes the ground and the rise due to the action of the extensors are so nearly coincident as to be indistinguishable. With the end of the contraction of the extensors, the foot is raised from the ground, and a low portion of the curve follows. The foot is on the ground about two and one-half times as long as it is in the air in each step. When tambours are attached to all four limbs, the records show that the extension of one fore limb follows closely the movement of the opposite hind limb. At times, however, the movement of the fore limb does not begin until just before the opposite hind foot is about to leave the ground. The fore limb does not extend until the hind foot of the same side is about to leave the ground. The fore and hind feet of the same side of the body are practically never on the ground at the same time.

The Cerebellar Gait: Extirpation of the left crus primum (lobule corresponding to the lobulus semilunaris inferior in man) affected the left fore limb primarily and the right hind limb secondarily. The ataxia of the left forelimb was marked, and the animal often fell to the left. The graphic records showed that the extension movement in the left fore limb often began prematurely, occurring almost simultaneously with that of the opposite hind limb. The secondary effect, probably indirect, on the right hind limb seems to be manifested in a tardiness of the action of the muscles of this limb. The period during which the left fore foot is in the air is longer than the period during which the right fore foot is in the air at each step. The period during which the right hind foot is on the ground is longer than the period during which the left hind foot is on the ground at each step. The time during which the left fore foot is on the ground is shorter than the time the right fore foot is on the ground. The time during which the right hind foot is on the ground is less than the time the left hind foot is on the ground.

In a second dog, the right crus secundum and a portion of the paramedian lobule (corresponding to the lobulus biventer and the tonsil in man) were extirpated. The right hind limb was primarily affected. The changes in the general time relations of the step were similar to those noted in the first dog, with the exception that left fore and right hind limbs are to be interchanged in the description.

In both dogs, the effects soon passed off, so that in two or three weeks, few changes in its gait were apparent on inspection. After this time, the changes in the records were rather indefinite.

The author finds no evidence of asthenia in the affected limbs, although, so far as I understand the apparatus, I fail to see where such evidence could be obtained from his experiments or observations. Holmes (*Brain*, Lond. 40:461, 1918) has recently confirmed Luciani's views as to the presence of asthenia in his study of a series of gunshot injuries of the cerebellum in man. Holmes also failed to find any evidence in favor of localization in the cerebellum, although he specifically states that his series of cases would not necessarily disprove the view of localization. It is to be noted that, while Meyers was dealing with cortical injuries, in Holmes' series, the destruction extended much below the surface. Whether the depth of the lesion has to do with the absence of localization and the undoubted occurrence of asthenia in Holmes' series it is not now possible to say. Meyers also failed to find any evidence of arrhythmia in the sense in which Luciani employed this term, to denote an unsteadiness or tremor in each single contraction of the affected muscles.

PIKE, New York

SEALE HAYNE NEUROLOGICAL STUDIES

THE HYSTERICAL ELEMENT IN ORGANIC DISEASE AND INJURY OF THE CENTRAL NERVOUS SYSTEM. A. F. HURST, M.D., and J. L. M. SYMNS, M.D., *Seale Hayne Neurological Studies* 1: No. 3. November, 1918.

1. From a large clinical experience during the past four years with soldiers, the authors emphasize the frequency of associated hysterical and organic nervous disease. The observations which they have made in the Seale Hayne Military Hospital in England and which are alluded to in numerous case reports, would appear to show that this association is much more frequent

than was formerly supposed. Every case in which an associated functional nervous element is conceivable should be tested by psychotherapy.

The associated conditions fall under two main groups. The first is one in which organic lesions and signs precede paralysis, but may still persist and progress following striking improvement in the associated functional disorder. This is exemplified in early disseminated sclerosis and tabes. A case of tabes is related in point. The patient was unable to walk for six years, but was again able to do so after a treatment by reeducational psychotherapy lasting a few hours only, and at the end of a week was able to walk normally. It is questioned whether benefit following Fraenkel's reeducational exercises is not due, at least in part, to suggestion. In disseminated sclerosis the ordinary remissions may be due to removal of the superimposed functional nervous disorder by suggestion, as, for example, following the administration of nonspecific drug remedies.

The second group consists of cases which are primarily organic but ultimately hysterical; the residual organic lesion being sufficient to produce physical signs with or without loss of organic function with tendency toward betterment. In this group a case is reported of combined hysterical and organic hemiplegia of two years' duration with almost complete recovery following psychotherapy; also cases of hemiplegia, paraplegia and blindness from wounds and shell concussions with remarkable improvement following appropriate treatment of the functional component.

The relative rôle which the organic and functional symptoms play in these different groups is illustrated graphically in a table of time and percentage incapacity. The writers classify some of the symptoms and signs which are supposed to distinguish organic and hysterical paralysis. Although it is generally considered that incontinence of urine is never hysterical, a case is mentioned in which such a condition following spinal concussion and lasting eleven months was cured by psychotherapy.

The waiting attitude in the treatment of acute organic nervous disease is condemned because functional capacity does not always tend to return *pari passu* with structural recovery unless the physician makes use of psychotherapy in combination with reeducation from the earliest possible moment. Treatment of this kind is also preventive against associated functional nervous disorders.

2. HYSTERICAL VOMITING IN SOLDIERS. W. R. REYNELL, M.D.

Hysterical vomiting in soldiers is comparatively common according to Reynell. He has observed eighteen cases in five months. The cases are amenable to treatment and cure by psychotherapy in a comparatively short time. The condition results from the perpetuation by suggestion of a symptom due to a pathologic condition. It therefore may follow gassing, dysentery, trench fever, surgical anesthesia, phthisis or appendicitis. In a number of cases emotion was the common cause. Characteristic symptoms are: independence of food, although most patients vomit after each meal; epigastric pain relieved after vomiting; the watery character of the vomit, and occurrence after slight emotional upsets or even slight physical exercise. Treatment by psychotherapy may be reinforced by the suggestive effect of the stomach tube. As the basis of this study the author suggests that the pernicious vomiting of pregnancy, and after surgical operations is often purely hysterical. The contentions of the writer are illustrated by case reports.

3. HYSTERICAL DISORDERS OF MICTURITION. J. W. MOORE, M.D.

Moore believes that experience with the war neuroses necessitates a revision of our views regarding hysterical disorders of micturition. A reference to the literature is made in which there is practically a unanimity of opinion that true incontinence of urine does not exist in a neuropath. The writer reports four cases of incontinence, one of them complete; and one case each of retention and "stammering bladder." The cases were readily cured by psychotherapy, hypnotism being employed in several cases.

4. HYSTERICAL OCULAR SYMPTOMS COMPLICATING CONJUNCTIVITIS. A. F. HURST, M.D., and C. H. RIPMAN, M.D.

This study with case reports is with special reference to gassing followed by ptosis, blepharospasm, spasm of convergence and accommodation and amblyopia. Inability to open the eyes which persists for more than three weeks after gassing can be presumed to be hysterical, unless well marked lacrimation is present. As inflammation subsides there occurs in abnormally suggestible individuals, anxious about their eyes, a voluntary inactivity of the levator palpebrae superioris which becomes perpetuated as involuntary activity or hysterical ptosis. Reflex blepharospasm is perpetrated as hysterical blepharospasm. The condition of hysterical blepharospasm and hysterical ptosis are usually present together but not always. An uneducated man if unable to open his eyes imagines he is blind. Hysterical blepharospasm and ptosis is often accompanied by hysterical amblyopia. Indistinct vision is due to a combination of hysterical paresis and spasm of accommodation and convergence.

5. HYSTERICAL APHONIA IN SOLDIERS WITH SPECIAL REFERENCE TO GASSING. A. WILSON GILL, M.D.

Aphonia is one of the commonest hysterical symptoms seen in soldiers and occurs most often following exposure to irritant gasses, but also follows other inflammatory conditions such as catarrhal laryngitis; or may be due to exhaustion, shock, emotion, wounds of the neck or laryngeal concussion. As a result of the stress and strain of war the soldier is liable to develop, at first by autosuggestion, the idea that some real and permanent damage has been done to his voice. This aphonia may be due to a flaccid or spastic condition of the laryngeal muscles compared to the flaccid and spastic varieties of hysterical paralysis of a limb. In the first variety the vocal cords remain in the cadaveric position, no trace of adduction occurring when an attempt is made to speak. The patient obviously makes no attempt to speak as can be easily determined by an external examination of the larynx. In the spastic variety on attempting to phonate both the true and false cords are tightly pressed together and the spasmodic action of the larynx is accompanied by irregular spasmodic action of the expiratory muscles, the chest becoming fixed, the face congested and the veins of the neck swollen.

The laryngological examination does not always reveal the true nature of the aphonia as the appearance of the larynx may suggest organic cause. A case is quoted in point cured by psychotherapy in twenty minutes, in which the laryngologist's report was "mucous membrane much atrophied; vocal cords practically nonexistent; this condition is permanent." In similar cases of mistaken diagnosis intralaryngeal methods of treatment may be directly harmful tending to further fix the neurosis.

Treatment is by simple persuasion and suggestion, neither electricity, the intralaryngeal catheter or ether anesthesia being employed, as was at first often the case. Assured of a cure by the medical officer the patient is first made to come in contact with other cured patients. The following treatment is preferably given alone. It is explained that the use of the voice has been forgotten; this has come about by the enforced silence following the inflammation of the vocal cords which has now disappeared. The patient is then asked to cough. The cough is compared to the sound of "one." He is then told to cough and say "one" immediately afterward. He often succeeds in the first attempt and is soon able to count and talk in his natural voice. It has not been necessary to limit smoking or to give any drugs. The treatment is the same in both the flaccid and spastic types of aphonia.

6. A STUDY OF EPILEPTIFORM CONVULSIONS IN SOLDIERS. R. G. GORDON, M.D.

Gordon calls attention to the large number of cases (4,257) diagnosed as epilepsy in those who had been discharged from the British service up to Aug. 31, 1918. He questions whether all of these cases should be classified as true epilepsy. The psychogenetic factors which cause a hysterical fit are discussed in a consideration of functional epilepsy. The cases referred to as having had true epilepsy are included in two groups. Firstly, are those patients who have true epilepsy in childhood or early adult life, but in whom the disease had apparently ceased until the occurrence of an emotional crisis; secondly, true epilepsy complicated by hysterical fits.

From the diagnostic standpoint there are only three signs which speak positively in favor of organic epilepsy. These are: (1) the extensor plantar reflex occurring after the termination of the fit. It is, however, fleeting—disappearing almost immediately after return of consciousness; (2) cyanosis hysterical patients being flushed as a rule, and (3) conjugate deviation of the eyes.

Treatment of the hysterical condition or associated condition may be undertaken by hypnosis or preferably by "autognosis," a term suggested by William Brown. By this term is meant that the patient is afforded insight into his condition and is made to understand thoroughly the pathogenesis of his fits. In carrying out this latter method the patient's confidence must be gained and he must be encouraged to fully detail the history of his case and symptomatology. Help may be obtained from an analysis of his dreams. The next step is to determine under what emotional conditions subsequent fits developed. He should then be taught how his emotional energy must be directed into proper channels, and how his mental make-up and attitude toward life must be stabilized. Conscious and unconscious worries must be given their proper values and mental powers of concentration and memory developed. Physical exercise should not be neglected.

7. A SERIES OF HYSTERICAL CASES IN SOLDIERS. G. MCGREGOR, M.D.

In this paper the case histories of eight cases of hysteria in soldiers are detailed to illustrate the widespread occurrence of functional disabilities in the Army and the ease with which they may be cured. Among the cases reported are: monoplegia, paraplegia, hysterical gait, aphonia, mutism and hysterical stiff joint.

SCHALLER, San Francisco.

Society Transactions

PHILADELPHIA NEUROLOGICAL SOCIETY

Regular Meeting, Jan. 22, 1919

MAX BOCHROCH, M.D., *President*

HYPNAGOGIC HALLUCINATIONS IN A RESTORED EPILEPTIC.

Presented by DR. N. S. YAWGER.

The patient Dr. Yawger had hoped to present is a girl of 15 years whose epilepsy declared itself at $3\frac{1}{2}$ years. At 13, when the child came under observation, she was having one or two attacks a week and occasionally as many as six during a night; her seizures occurred mostly when asleep.

The girl is said always to have been slightly mentally subnormal. At 13 years she was placed in the Oakbourne Epileptic Colony where her medicinal treatment for the first few weeks was 3 grains of chloretone daily; the drug was subsequently increased to 6 grains, which amount was continued for many months. Since September, 1917, there have been absolutely no epileptic seizures.

It is of unusual interest that for years this girl has been experiencing hypnagogic hallucinations. By these one understands the optical manifestations of a few persons, observed during the transitional stage from wakening to slumber, in which objects or scenes of various kinds pass rapidly before the sight. Some individuals observe these hallucinations with their eyes open, but more commonly they are closed.

These manifestations are seen by this patient after closing her eyes, just preceding sleep, and sometimes they are so distressing as to interfere with sleep. Dr. Yawger observed that by blindfolding the child the hallucinations could be induced at any time. She does not lend herself willingly to the procedure and usually struggles to get free; even talking afterward about the matter as distasteful to her.

Once, Dr. Yawger recalls, while experimenting with her she said, "There is a little dog," and groped blindly toward the object of her fancy; her eyes were uncovered and five minutes later when the subject was mentioned, she walked into the adjoining room where she thought the dog had disappeared and in surprise said, "Well, he is gone, but he was a nice dog anyway." At times the experiment is followed by decided drowsiness and the child will rub her eyes as though just wakening.

This is the fourth instance in which Dr. Yawger has encountered hypnagogic hallucinations—twice in normal persons (*Journal Abnormal Psychology*, June, 1918) and twice in epileptics.

DISCUSSION

DR. S. L. IMMERMANN said that he had had a patient in the hospital who so far as he could tell was a case of general paralysis of the insane. He had dementia and all the signs that usually go with paresis. He claimed that by closing his eyes he could see women in front of him. He described their

size and how they looked and so on: He seemed to realize that there were no women there, that they were imaginary. He also had auditory hallucinations, real auditory hallucinations, which he did not recognize as such, while he would talk about these women which he did recognize as having no reality. Dr. Immerman said he thought it had been stated of Goethe, that he could produce some kind of visual hallucinations at will. He could see some kind of fancy figures with eyes open or closed. He did not know whether this could be called an hypnagogic hallucination, but it seemed very much like it.

A CASE OF NERVE SYPHILIS WITH ACUTE INVOLVEMENT OF THE AUDITORY NERVES AND COMPLETE DEAFNESS. Presented by DR. JAMES HENDRIE LLOYD.

Involvement of the eighth nerve in syphilis has come to be recognized as not only an important but also a much more common feature of syphilis than we have heretofore been in the habit of regarding it.

The patient was a negro, a ship-cook, about 30 years of age, a large robust man who had always been in good health. In June, 1917, he was treated in the venereal wards of the Philadelphia Hospital for a chancre and secondary eruption. At this time he had one treatment with arsphenamin. Later he had a syphilitic iritis, for which he was treated in the eye wards. There is no record at this time of any nervous symptoms. He left the hospital and apparently returned to his work, but about two months later, while on ship-board, he was taken with a severe frontal headache, worse at night, and so severe as to force him to give up work and return to the hospital, where he was admitted to the nervous wards.

On first examination the man's only complaint was of the headache, which was urgent and led him to beg for relief. The right pupil was dilated and rigid, the result of the iritis, and there was some visible congestion of the eye. The left pupil reacted sluggishly to light. Other examination as to cranial nerves, gait and sensation was entirely negative, except that the knee-jerks and Achilles jerks were much diminished. There was no Romberg symptom or ataxia. As a routine measure the hearing was tested, and no deafness was observed.

Both the blood and cerebrospinal fluid were positive, and a very high lymphocytosis was reported—1,600 cells to the cubic millimeter. Later after treatment the blood became negative, but the cerebrospinal fluid remained positive, although the cell count was much reduced. He was given a mixed treatment with mercurial inunctions and several doses of arsenobenzol.

In October the report from the ear clinic was that hearing was normal, but late in November the report was that hearing was somewhat impaired, but the drum membranes were normal.

The man remained under observation during most of the winter. The headache had entirely disappeared, as had also the iritis—which, however, had left a rigid pupil and clouded medium. The fundus of the other eye was normal. The patient's condition was satisfactory. Later he eloped from the hospital and was gone several weeks. In March, 1918, he returned. By this time he had become very rapidly deaf—to such a degree that it was difficult to speak with him. The report from the ear-clinic at this time was as follows: In the *right ear* there was mixed deafness; the involvement of the receptive apparatus seemed to be confined to the labyrinth. In the *left ear*

mixed deafness from the standpoint of the receptive apparatus was extensive and seemed to indicate that the lesion was in the course of the nerve—or central. Active treatment since that date has not relieved the patient of his deafness.

According to Dr. G. W. Mackenzie of Philadelphia, who has recently contributed an important article on this subject, syphilis may affect the inner ear alone, the eighth nerve alone, or both combined. It may involve either the cochlear branch, or vestibular branch, or both. It is commonly bilateral, one-sided cases being very rare. It may occur as a mononeuritis, or a polyneuritis, being then involved along with the second, fifth and seventh nerves especially. It may occur very early after the primary infection—in fact, as early as the seventh day, according to Politzer. Randall saw a case in a physician, following a needle-wound of the finger, in which the deafness occurred at the end of the fourth week. Its progress may be very rapid, and if it is not treated heroically, it may lead quickly to incurable deafness. It is the cause of deafness in congenital or hereditary syphilis.

It is highly important that neurologists should recognize the possibility of this invasion and be on the lookout for it—just as much so as in the case of the optic nerves. It has been charged by some observers that this affection of the eighth nerves has been caused by the use of arsphenamin, just as this accusation has been made in the case of the optic nerves. Mackenzie criticizes this claim very carefully, and does not accept it, but believes these cases are instances of neurorecidivus, in which the treatment has not been sufficiently active.

As to the pathology, it seems that the nerve may be attacked either primarily or secondarily to the membranes. The labyrinth itself may be invaded, and in the congenital cases the bone also has been involved. There are many nice questions as to the mode and order of onset, but these can well be left to the pathologists who delight to expound the minutiae of such subjects.

DISCUSSION

DR. WILLIAM G. SPILLER said that the isolated paralysis of cranial nerves in syphilis is a remarkable phenomenon. He had seen paralysis of both facial nerves without implication of any other cranial nerve; he had also seen paralysis of the trifacial nerve alone. It is difficult to explain the occurrence of paralysis of both acoustic nerves or of both facial nerves without other cranial nerve disorder. Possibly the explanation may be found in the anatomic relation of these nerves. They are situated in the angle formed by the medulla oblongata, pons and cerebellum, and when the patient lies on his back the syphilitic poison might settle in these depressions so that the structures situated here would be exposed to greater intensity of the poison than would other structures.

This is an explanation that also may be offered for the greater intensity of syphilitic meningo-myelitis in the posterior part of the thoracic cord. It is common to find the syphilitic lesions more intense in the posterior than in the anterior part of the spinal cord. The patient in lying on his back exposed this part of the cord to a cerebrospinal fluid which by gravity contains a greater amount of syphilitic poison.

The acoustic nerve is often affected in tabes and it is not surprising therefore that it should be affected in cerebral syphilis, but isolated paralysis of the acoustic nerve is decidedly rare, while isolated paralysis of the oculomotor nerve is common.

DR. CHARLES S. POTTS said that he had not heard Dr. Lloyd's paper, but two years ago he had presented a case before the Society from the Philadelphia Hospital in which the only evidence of syphilis was bilateral disease of the eighth nerve and also of the optic nerves. This man was apparently cured, at least he left the hospital practically well after a rather intensive treatment with arsphenamin and mercury.

REMARKS ON BRAIN TUMORS IN PSYCHOPATHIC SUBJECTS.

DR. S. L. IMMERMAN.

These remarks are based on the findings of three cases of brain tumor, discovered at necropsy, out of seventy-five necropsies, in the last three and one-half years, on patients from my wards at the Philadelphia Hospital for the Insane.

CASE 1.—This patient was admitted in 1903, at the age of 43, on account of dementia. He died of acute hemiplegia in 1917, without previous localizing symptoms. His eye-grounds could not be examined on account of old phthisis bulbi. Necropsy revealed a right-sided parietal glioma, which had recently impinged on the cortex by expansion from hemorrhage.

CASE 2.—This patient was a middle-aged man, confined to the institution for three years on account of dementia. He showed optic neuritis with hemorrhage, diffuse signs referable to his central nervous system, and a positive Wassermann reaction in his blood and spinal fluid. Necropsy revealed a cerebello-pontine tumor—a sarcoma.

CASE 3.—This patient, a man, aged 65, died several months after admission to the hospital. There was no history. He showed apathy and somnolence; no localizing signs; eye-grounds were not examined. Necropsy revealed a left frontal lobe tumor—an endothelioma—which had also involved part of the corpus callosum, and right frontal lobe.

The practical conclusions to be drawn from these cases, though not new, are worth emphasis:

1. Patients suffering from brain tumors may be sent to psychopathic hospitals, usually under a mistaken diagnosis of paresis, epilepsy or chronic dementia.
2. Certain kinds of mental symptoms are suggestive of brain tumor.
3. Even in the absence of definite localizing signs, certain mental symptoms should lead to examination for brain tumor.

DISCUSSION

DR. SAMUEL T. ORTON said that Dr. Immerman has brought over the tumor and it had proved to be a rather interesting one. The tumor had been in formalin and so did not lend itself to finer histologic methods. Special stains showed more or less what the characteristics were. The tumor he thought belonged to the endothelioma family, but a very low grade. Dr. Orton said he was able to rule out the spindle cell type by special tissue stains and that left us practically with the diagnosis of sarcoma or endothelioma. The tumor cells were themselves very relatively small, the nuclei small and less vesicular than one expected to find in a characteristic endothelioma. The structure of the tumor did not show whorl formation, did not show any tendency to flatten out over the surface of connective tissue strands or over the vascular structures, and did show a certain amount of fibrillation of the cytoplasm. He thought the fibrillation was enough to rule out the cellular glioma and

probably a sarcoma. The tumor was a very slow growing one and exhibited considerable hemorrhage. On the whole, although the tumor was of considerable size, it had probably been growing for a considerable period. Dr. Whitney reported a patient in the Worcester Hospital in whom the tumor reached the size of a small lemon, and whose history they were able to trace back for approximately twelve years. Only for the last six months was the man sufficiently incapacitated to bring to the hospital. That also was an endotheliomata, slow growing and malignant only in the sense of producing pressure symptoms. That tumor had produced a paralysis late by secondary softening and probably not by any direct pressure on the motor areas themselves.

LUMINAL IN EPILEPSY AND IN DISTURBED AND EXCITED STATES. (Special Communication.)

DR. FRANCIS X. DERCUM spoke briefly on the subject of luminal and luminal sodium. His attention had first been directed to the great value of luminal in disturbed and excited states by an article in the *Journal of Mental Science*, July, 1914, by Dr. Richard Eager. It occurred to Dr. Dercum to make a trial of the drug in epilepsy, and he has done so with the most gratifying results. At first he had given the drug three times daily as in the common administration of the bromids. He found, however, that used in this manner it sometimes made his patients a little heavy during the day and, at times, even a little dizzy. He found that if he limited the administration of the drug to one dose at bedtime, that these symptoms did not appear while the efficiency of the drug was in no wise impaired, if indeed it was not enhanced. He found that in epilepsies, even when most confirmed, the drug exercised a remarkable control over the seizures. The latter were usually promptly inhibited altogether. The doses required were exceedingly small. A grain and one-half of luminal or 2 grains of luminal sodium given at bedtime were ordinarily sufficient. Very rarely had he been obliged to give so large a dose as 3 grains. In a number of instances the use of luminal as here indicated had resulted in the abolition of the convulsive seizures for periods extending not only over many months, but even over several years. It was in the group of the "essential" or "morphologic" epilepsies that the efficacy of the drug has proved most remarkable. Indeed, in some of the cases, the luminal acted virtually as a specific. It is noteworthy, too, that at no time was the slightest deleterious or untoward effect noted. Respiration, circulation, temperature are uninfluenced—even by the most prolonged administration—nor is there any induction of a drug habit or craving, for the action of the remedy is unattended by either pleasurable or disagreeable sensations.

In regard to the efficacy of luminal in disturbed and excited states, Dr. Dercum was able to confirm the observations of Dr. Eager. Here it also proved to be of the very greatest value. He instanced, among others, its action in a case of chorea insaniens. The latter presented a typical history. Some four weeks before her admission to the Jefferson Hospital, the patient had been delivered of a child and during the puerperium had developed the chorea. At the time of her admission the movements were violent and incessant. The patient had been much exhausted, had been practically sleepless for a long time, and had become actively hallucinatory and confused. Three-grain doses of luminal sodium were given hypodermically at intervals of four hours. The results were almost immediate. Some twenty minutes after the first hypoder-

mic injection, the movements grew markedly less, and after a few repetitions of the dose ceased altogether. The patient began to sleep and to take food and subsequently made a very prompt and uneventful recovery. The result in this case was truly remarkable, when we consider how fatal chorea insaniens commonly is. In other cases with disturbance and excitement, Dr. Dercum has since used the drug with equally good effect.

Luminal sodium is very soluble. Its hypodermic administration is unattended by any local irritation and no unpleasant after-effects are experienced. Naturally, however, we should be cautious and tentative in its use.

Luminal belongs to the series of adalin, veronal and medinal. Unfortunately, the supply in this country is practically exhausted. It is to be hoped that our own chemists will be stimulated to manufacture this drug, which Dr. Dercum maintained has a remarkable and unique therapeutic value. Its action in epilepsy, used in the manner indicated, was incomparably superior to that of the bromids, while the facts as to its efficacy in disturbed and excited states generally reveal it to be a drug of great range of usefulness.

NEW YORK NEUROLOGICAL SOCIETY

*Three Hundred and Seventieth Regular Meeting, held at the
Academy of Medicine, Feb. 4, 1919*

FREDERICK TILNEY, M.D., *President*

A CASE OF SUCCESSFUL REMOVAL OF A TUMOR OF THE SPINAL CORD. Presented by DRs. C. C. BELING AND ALFRED S. TAYLOR.

The patient, an American woman, aged 39, is today apparently perfectly well. She was first seen Jan. 6, 1916. Three months before she noticed that her feet were numb, especially the ends of her toes. After a short period of time—how long she does not definitely remember—she began to experience a feeling of general stiffness and lameness, which increased gradually. This was followed by an intense localized pain in her back, across her shoulders and radiating down the right arm as far as the elbow. It was more excruciating at night, especially after she went to bed. In her own words, "One day it was an ache, the next day it was a pain, and the next day it was as if I were being lashed across my shoulders." From then on the numbness in both lower extremities increased and was more marked in the right. The right leg felt much stiffer than the left during locomotion. Her bowels were constipated and she experienced some detrusor weakness in urination.

Examination showed a Brown-Séquard type of lesion of the spinal cord at the level of the fourth dorsal vertebra. She entered the Newark City Hospital on Jan. 11, 1916, and remained under observation until January 15. Blood and urine examinations were negative and Wassermann tests of the blood and spinal fluid were negative. Roentgenograms showed some obscure bony thickening about the fourth and fifth vertebrae. About January 25 the sensory disturbances extended upward and spread into her arms and hands, and the paraplegic symptoms became more pronounced.

Regarding the sensory findings made the day before operation, the relative levels of the receptors for touch, pain, heat and cold were interesting. The pain receptors occupied the lowest level, touch the next, followed by the heat and the cold receptors. Another remarkable feature of their distribution in the skin was their coalescence and interlacing at the axillary and cubital

flexures. These sensory features were evidently of biologic significance, and showed an evolutionary adaptation of the organism to environmental influences.

Operation was advised and was performed on Jan. 31, 1916, by Dr. Taylor. A right unilateral laminectomy was done, involving the laminae of C₄ to D₅ inclusive. When the bone was removed there was a palpable tumor beneath the dura, just about in the middle of the exposure. The dura was split the full length of the exposure, and a soft, friable, vascular, lobulated tumor was found, situated chiefly on the right side of the cord dorsally, and extending a little backward and over to the left of the median line dorsally, and forward along the right lateral aspect of the cord. The tumor was about 6 cm. long by 2.5 by 1 cm. It appeared to be situated beneath the arachnoid membrane. After the arachnoid was divided over the tumor it could be peeled out with comparative ease, and seemed to have no direct adhesions to the cord substance. The posterior veins of the cord were intensely congested. The cord was somewhat flattened postero-laterally on the right side. After careful hemostasis, the edges of the dura were sutured by interrupted fine catgut sutures. The muscles and aponeurosis were closed by chromic catgut and the skin by silk. No drainage was used.

On March 6—the thirty-fifth day after operation—she had a large, formed, voluntary stool, and from that time on had control of the bowel. On March 11—forty days after operation—she was able to take a few steps, with assistance, and was taken home on that date. From this time on there had been steady improvement.

Pathologic examination and report state that the tumor was an atypical neurofibroma. At one point near the middle of the tumor a nerve was found, the branches penetrating the growth. It was very cellular in some places, while in other places fibrous elements predominated. The blood vessels showed dilatation, thickening, congestion, and a nuclear increase in the vessel walls. In some places the vessels appeared obliterated and there were many small hemorrhages distributed throughout the field.

DISCUSSION

Dr. I. ABRAHAMSON thought it was very unusual in a unilateral tumor to get bilateral sensory symptoms so early. All the signs seemed to have pointed to its being an extramedullary tumor. Fourteen years ago he showed a case of extramedullary tumor without pain in which the first symptom was paresthesia, at first in the toes of the right foot, and soon afterward in the left toes, one of the earliest cases of neoplasm of the cord without pain that he had ever seen. The tumor was found, as diagnosed, antero-laterally situated.

Dr. JOSEPH BYRNE remembered a case parallel with this one except that the growth was a little further down in the cord. In that case, the symptoms were almost like those of Dr. Beling's case, beginning with root pains around the level of the twelfth thoracic on the left; this was followed by stiffening in the left foot and then by weakness in the other foot after several years. This tumor took from ten to eleven years to develop to full maturity. In the meantime the patient gave birth to three children. Dr. Taylor removed the growth in a unilateral laminectomy as in this case. Notwithstanding the fact that the tumor was as large as a Brazilian nut the exposure through the unilateral laminectomy gave a very satisfactory view of the growth and the cord and was quite adequate in every respect. Though the tumor was successfully removed the patient succumbed the day following operation. She had been a victim for years of mitral insufficiency.

THE OPPORTUNITY OF AMERICAN NEUROLOGY. (Address of the Retiring President.) Delivered by DR. FREDERICK TILNEY.

Dr. Tilney ignored the academic, for in the light of the great changes that had occurred throughout the world in the past two years, the opportunity of American neurology was practical, broad in its scope, compelling in its demand, and entering with insistence into the life of every neurologist. Recent and present events made the future for them alluring to contemplate. Among the changes that the war had brought about was the prominence given to learning and the pursuit of knowledge, probably because it had been shown that education was one of the main supports of civilization. Renewed interest had been aroused in the psychologic and sociologic studies of man and his conventions. The destruction of war had placed Europe at a disadvantage in its intellectual pursuits. This fact should be recognized at once in America as an opportunity for service, the purity of motive being enhanced by the lack of aggrandizing competition. America, having at last taken her place beside the valiant, hard-pressed champions of right and turned the scales to victory, had come to know her usefulness. The entire country seemed everywhere to recognize this; everywhere was a new spirit, a new alertness and comprehension. What was true in all other lines of activity, commercial, intellectual, educational, was also true of the medical profession. The opportunities for work in the growing fields of human service were the chief topics of conversation in medical circles and among medical men.

The phase that interested neurologists most intimately was the development and advance of neurology in this country, and it was to the opportunity presented by combined and well organized effort that American neurologists must address themselves. Assuming that this fact was recognized in a general way, practical consideration made it necessary to consider the problem from the standpoint of locality, and the question arose, how could each contribute most and proceed most efficiently in the general forward movement in the interests of neurology. Other cities throughout the country would have their problems to solve, but those here in New York were particularly difficult and demanded not merely vision and patience, but a large and generous consideration of the whole situation. There was no place today where it could be said that the diseases of the nervous system received adequate postgraduate attention. New York City contained in its many scattered institutions a wealth of neurological material probably surpassed nowhere in the world. Here also was a distinguished group of workers in neurology and psychiatry whose distinction and services could be enhanced by coordination in their efforts. With such an obvious opportunity and need, together with the material and the workers, New York could readily be made a leading center in neurology and psychiatry. The fundamental requirement to achieve this end was coordination, and if this could be brought about it would serve to do away with many of the difficulties which stood in the way of neurological progress, and would mobilize the wealth of clinical, pathologic and morphologic material to mutual advantage as well as for advanced teaching and research in neurology and psychiatry. The success of such an undertaking would depend almost entirely on the individual enthusiasm and real devotion for the best interests of this particular subject.

In retiring from the office of president of this Society, Dr. Tilney expressed his sincere appreciation for the loyal support that had been accorded him in his attempts to serve the best interests of the Society during the past two years. It gave him great pleasure to welcome Dr. Timme to the chair.

LAMINECTOMY FOR INTRAMEDULLARY (?) TUMOR OF THE SPINAL CORD REMOVED BY TWO-STAGE OPERATION; LATER LAMINECTOMY AND POSTERIOR ROOT SECTION FOR SPASTICITY; REMARKABLE IMPROVEMENT. Presented by DR. CHARLES A. ELSBERG.

A young woman, aged 17, was admitted to the neurological service of Dr. Sachs, Mount Sinai Hospital, in January, 1912. She gave a history dating back a year, of increasing weakness in all four extremities with marked sensory disturbances and changes in her reflexes. She had been treated for a period as a case of Pott's disease and had been in a plaster cast. Her symptoms were those of a compression of the spinal cord at the seventh dorsal level and she was transferred to the surgical service for operation. On March 20, 1912, Dr. Elsberg performed a laminectomy, removing the arches of the sixth and seventh cervical and first and second dorsal vertebrae. When the dura was opened a tumor 2 inches long situated on the posterior surface of the cord was exposed. The tumor was either covered by a thin capsule or it was covered by a thin layer of spinal cord tissue; this could not be definitely determined. The tissue over the tumor was incised and the wound then closed for the time being. A specimen of the tumor was removed for examination. The patient had lost complete control in the lower extremities and had very little power in her upper extremities when she was operated on. Within a few days of the operation she improved very markedly and had recovered considerable power in both upper and lower extremities.

One week later the wound was reopened and the tumor was found to be lying outside of the cord. The pathologic report was that the tumor was a fibro-lipoma. When attempt was made to remove the growth it was found to be still partly embedded in the cord, but with care it was carefully peeled out of its bed. As the result showed, this procedure was wrong. The operation was done in the early period of the knowledge of intramedullary surgery and the proper procedure should have been to have excised the tumor outside of the cord and to have left the remainder in situ. It was always most inadvisable to attempt to enucleate a tumor when partly embedded in the cord substance, because even with the gentlest manipulation there was severe trauma to the cord. Recovery from the second operation was normal but the patient presented within twenty-four hours all the symptoms of complete transverse lesion of the cord with paralysis of all the extremities and loss of all reflexes. This condition persisted; she developed large bedsores and a severe cystitis, had irregular fever from the cystitis, the bedsores lasted for many weeks and her condition was deplorable. She remained so for several months, and then gradually improved. The lower limbs, however, gradually became spastic, and by April of the following year were markedly contracted, and flexed at the knees and hips almost to the body. Finally, an attempt was made to ameliorate her condition somewhat by posterior root section for the spasticity of the lower limbs. On April 2, 1913, laminectomy was done, and the second, fourth and fifth posterior roots on each side were divided. The patient recovered satisfactorily from this operation and the contractures in the lower limbs gradually relaxed so that within two months the legs were fully extended. For about two years she had little power in her lower limbs but considerable return of power in her upper limbs, and her condition was considered hopeless. In 1918, she returned to the hospital remarkably improved. The power in her upper extremities was now normal and she had good power in her lower extremities excepting for a slight limp on the left side when

she walked. She has remained in excellent condition since that time and she was presented at the meeting, and walked around without any trouble, with only a slight limp. The patient was presented in order to show what remarkable recuperative powers the spinal cord has even after a number of years, what can be accomplished by surgery, and finally as an evidence of the dangers of intramedullary surgery.

Dr. Byrne remembered seeing this case at the Neurological Hospital some years ago before she went to Mount Sinai for the second operation. At that time she had very poor use of her limbs and he tried to think of some reason to account for this. He concluded that the interference with cord function was the result of an inflammatory reaction following the evulsion of the tumor at the first operation in that region and the cord succumbed, a condition similar to spinal shock. He thought the case remarkable as illustrating what surgery could do for one so helpless. Considering the condition in which he saw the patient, one would have thought it almost impossible that anything could have been done to restore function to the degree that she now enjoyed.

A CONSTRUCTIVE PLAN FOR ADVANCEMENT IN NEUROLOGICAL THERAPEUTICS. (Address of the President-Elect.) Delivered by DR. WALTER TIMME.

Dr. Timme deplored the fact that neurology had made only moderate advance in recent years, the real advances in this special field having been made by other than neurologists; as, for instance, the spirochete in paresis, demonstrated by a bacteriologist, and arsphenamin introduced by a biochemist. Neurologists should be far ahead on the highway of modern advance, and recognition of their failure to be in the vanguard would, it was earnestly hoped, bring about constructive changes and plans for the immediate future. A glance at recent transactions of neurological societies would show the fairness of this criticism, which was intended to be constructive, not destructive, and which referred not to any one or any group, but to all as a collective unit. These transactions were clouded in a maze of qualifying phrases, limiting applications and newly coined terms which prevented in many cases any approach at understanding. Another disconcerting feature to be found in them was the reduction of individual experiences to statistical tables. When a man reduced his observations—say of disseminated sclerosis—to figures, apportioning a certain percentage to respective types, grouping them under certain symptoms, etc., it would appear that he felt that this was the end of the subject for him, and this represented his attitude toward his patient. Once let the diagnosis of disseminated sclerosis be made and all further interest in the patient was lost. This might be cited about almost any other organic neurologic condition. It was this method of closing a subject that had led organic neurology into a box cañon from which there was no escape ahead but all egress must be made by retreat.

Such a condition of affairs was not found in other fields of medicine; witness the introduction of serum therapy, of protective vaccines, the discovery of the hemolytic reactions, the invention of the electrocardiograph and other epoch making advances. Against these advances in other fields of medicine neurology could show nothing in the cure of conditions that should be considered within its particular domain. As for the neuroses all that was done for them was to classify and reclassify them, and the psychoses were regarded in terms of terminology and statistics. The paths for emergence

toward the light were occupied by other than neurologists; the endocrinologists were concerned with the dystrophies, the myopathies and the asthenias, and the subject of visceral neurology belonged almost exclusively to them. Poliomyelitis had become the concern of the pediatricists and orthopedists. The genito-urinary specialist included neurosyphilis in his domain. The dentists cured the spondylites, the neuralgias and reached out for the insanities. The psychoanalyst made heroic attacks on every single condition coming under the category of neurology and psychiatry, and frequently with success. It was time for the neurologists to join the order of the day and become revolutionists. It should not be difficult to get together in a spirit of harmony and cooperation and formulate a plan whereby methods of stagnation should be abandoned for those of active endeavor and accomplishment.

Dr. Timme suggested the following as a constructive plan of action: Why could not an authoritative body representing American neurology choose from among its members a number to whom would be assigned a specific neurologic disease or syndrome for treatment? Each member of such a group might take a subdivision of the subject chosen and bring it up to date. A year might be allowed for the work. At the end of that time, there would be accessible in compact form all that had been written on that disease throughout the world to date. Two such groups a year would soon give to neurology a series of archives which would be invaluable as starting off places for investigation. The concrete method of obtaining the best results in a short time might very well be initiated by the New York Neurological Society in collaboration with neurological units elsewhere throughout the country. The publication of such exhaustive reviews might then be properly within the scope of the American Neurological Association.

A second recommendation, a corollary to the former, might be of value in fostering a spirit of research and investigation. This would embody the reward of a prize for the greatest yearly advance made in some neurological subjects, or for the winner in a competitive essay.

By these two means, an immediate direct stimulus would be applied to American neurology which would give to it a dynamic character and which would be cumulative as it progressed. There was a broadening scope for American neurology and a great desire for unification of neurologic interests, particularly in this city, which would make it the center of neurologic thought and advance. The immense economic factor that problems in neurology and psychiatry had become in modern organizations had been made plain through the great war and a tremendous awakening in all branches of these sciences was already manifest. The position, the power and the ability to encompass this great end were only awaiting the will to utilize them.

THE LESIONS ENCOUNTERED IN OPERATIONS FOR OLD INJURIES OF THE SPINAL CORD: WITH REMARKS ON THE INDICATIONS FOR TREATMENT AND RESULTS OBTAINED BY SURGICAL INTERFERENCE. (With Lantern Slides.) Presented by DR. CHARLES A. ELSBERG.

Among 200 spinal operations performed at the New York Neurological Institute and at Mount Sinai Hospital, a number of old traumatic lesions had been encountered, which could be divided into those which involved the membranes and those of the cord and roots. Combinations of these types were often observed in a single patient. Many injuries to the vertebral column

and spinal cord produced an irremediable cord lesion, but in a small number it was not severe so that improvement was possible and some of these required operative interference. Changes in the dura frequently resulted from trauma to the spine. The dura might be much changed and so greatly thickened that it exerted pressure on the cord, in which case excision of the thickened part might be followed by improvement of the symptoms. The appearance of the dura might be so altered as to be mistaken for an extradural neoplasm; great care in excising it should be taken in order to avoid injury to the cord beneath. The cord might be adherent to the dura and the arachnoid sac obliterated, or the arachnoid sac found to be shut off above and below the lesion. Calcareous deposits on the inner surface of the dura might cause some root pains or marked cord symptoms. They should be removed, but great care should be exercised for they were often firmly attached to the surface of the cord. Sometimes symptoms very like those of extramedullary neoplasm were caused by a mass of scar tissue formed from adhesions between the pia of the cord and the dura. Part of this cicatricial tissue might be so firmly adherent to the cord that the only course to pursue was to make parallel incisions through the scar tissue. Cicatrices in the dura, especially around the cauda equina, might cause severe root pains; excision of the scar tissue would usually relieve the symptoms, but it might sometimes be necessary to divide or excise the affected roots.

The changes observed in the arachnoid varied widely. Sometimes it was slightly thickened and cloudy; at other times, a localized area on one or the other side of the cord was thickened, cloudy and adherent to the inner surface of the dura. More often, the arachnoid was not only thickened and adherent to the dura, but had also formed adhesions to the spinal cord so that cavities filled with fluid might result. New blood vessels were apt to be formed if these arachnoid changes occurred in the neighborhood of the posterior nerve roots. In those patients where the arachnoid was destroyed and the arachnoid sac obliterated in the traumatic area, the subarachnoid space was found to be shut off above and below and filled by pent up cerebrospinal fluid.

The appearance of the spinal cord months or years after injury also varied widely. Extremely small gross changes might produce very severe symptoms and very marked loss of function. The cord, however, often appeared larger than normal and its consistency less firm. Signs of an abnormal amount of fluid within were observed where there was a cavity in the cord. The largest cavities were usually seen in the lower dorsal lumbar and sacral regions. In some of these patients drainage of the fluid into the subdural space might result in great benefit to the patient. Very marked cord symptoms might be caused by distortion or narrowing of the spinal canal by new formed or dislocated bone. The cord might be stretched over a projecting mass of bone and be also subjected to pressure in which case marked cord symptoms might result. Great improvement had often followed the removal of the projective piece of bone, and the marked angulation described might be overcome by wide decompressive laminectomy.

There was no well supported evidence that the tissues of the cord could regenerate; therefore, operations for complete division of the spinal cord should never be attempted.

Indications for operative interference in lesions following old injuries of the cord could be summed up as follows: (1) Surgical relief was impossible if symptoms of complete transverse lesion had existed from the time of the trauma; (2) there was no hope of benefitting a patient with symptoms and

signs of incomplete cord lesion who had large bedsores and was much emaciated; (3) individuals who had improved but still had paraplegia should be operated on unless there was dissociated disturbance of superficial sensation; (4) if there was considerable return of power, but locomotion was still interfered with by the spasticity which had become stationary, operation was followed by satisfactory results, and (5) severe root pains, if they could not be otherwise relieved, might demand operative interference. Among the last 200 laminectomies performed by Dr. Elsberg, twenty operations were done for spinal lesions due to old trauma to the vertebral column. Of these, eight were completely relieved of symptoms and six were greatly improved. In six there was little or no improvement.

DISCUSSION

DR. WALTER F. SCHALLER complimented Dr. Elsberg on his excellent and timely presentation of a subject of interest to all neurologists. He considered it quite possible that in post-war surgery there would be an increasing number of these old spinal injuries as compared with former times. In recently reviewing the war injuries of the spinal cord he had been impressed by observations of certain conditions with which he had had no personal experience and he wished to ask if Dr. Elsberg had ever noted such cases. For instance, the presence of meningeal adhesions had been noted developing soon after gunshot injuries both above and below the wound and this explained the rarity of serious complicating meningitis in these cases. Further, the presence of circumscribed serous meningitis was often referred to in traumatic spinal cord conditions, and the speaker wished to know if Dr. Elsberg had encountered this condition frequently.

DR. HYMAN CLIMENKO said that some three or four years ago, together with Dr. Newhoff he made a study of a group of cases of old injury to the spinal cord, and obtained some results that might be of both medical and legal value. One patient, a painter, aged 40, had fallen from a scaffold and suffered from a complete paraplegia. He was confined to bed for about eight months when he began to improve gradually and steadfastly until at the end of about one year he was able to return to his work. Four years after the injury the symptoms of paraplegia returned and the patient was sent to the Central and Neurological Hospital. Here he presented a typical picture of spastic paraplegia with distinct level symptoms. Operation was performed by Dr. Newhoff who found a thickened dura with numerous adhesions. A piece of dura was excised and the adhesions freed. The cord did not appear to be badly damaged. The patient made an uneventful recovery from the operation, his paraplegic symptoms rapidly improved and within less than two months he was able to leave the hospital and return to his work. Within a year he returned, again paraplegic. The symptoms now had developed considerably. This case illustrated the fact that one must be careful about giving a good prognosis in court proceedings in so-called cured traumatic paraplegias. This case was also in accord with the observation quoted by Dr. Schaller regarding adhesions above and below the level of the traumatic lesion. Another remarkable case was that of a Negro who suffered from a syphilitic paraplegia. Specific treatment had no effect and operation was decided on. Here, too, adhesions were found and freed and the patient improved for awhile. The symptoms, however, soon returned. In this series also there was a case of multiple sclerosis with level symptoms. A laminectomy apparently helped the patient considerably, but the symptoms soon returned.

All these cases were under observation for a considerable length of time and, in general, it might be said that they all improved after operation, though sensation returned much more and earlier than motor powers. The pathologic findings in these cases were almost the same as those seen by Dr. Elsberg.

DR. ELSBERG assured Dr. Schaller that he had been on the lookout for so-called circumscribed serous meningitis. He had seen it in patients with injuries affecting the dura, but the process usually involved the arachnoid membrane and not the pia mater. Whenever he had seen an inflammatory process of the pia inside the arachnoid, he had considered the process as : meningo-myelitis. He had seen collections of fluid in the arachnoid sac, and felt it was due to an inflammatory process and adhesions of the arachnoid and not of the pia. After old severe injuries one might meet with adhesions between all the membranes and the cord, and he had long ago learned that in cases of that kind operative interference did no good.

PREVALENCE OF INFECTIOUS LETHARGIC ENCEPHALITIS. Presented by DR. I. ABRAHAMSON.

The speaker called attention to the alarming frequency with which this condition was now being encountered in private practice throughout the city. Various types had been established. Among them was a type where the third nerve was involved, or the pons and medulla, paraplegia or hemiplegia. There was a type with involvement of the cervical cord. One case he had seen was an acute Parkinson's disease beginning with diplopia and ptosis, in a highly intelligent man who had been absolutely without symptoms before, whose statements were fully corroborated by his wife.

Dr. Abrahamson had just received the discussion of infectious encephalitis which preceded an attack of influenza on the other side and which the Royal Medical Society had studied. The report was dated Oct. 22, 1918, and Sir William Osler, Dr. George Draper and Col. James Newsholme were members of the committee. They first studied the cases from the point of view of botulism and found they could exclude it. They then considered the relationship of the condition to poliomyelitis, but it was found to differ very materially; animal experiments were done but in no case did they get any picture resembling poliomyelitis. The condition was *sui generis* and differed from all analogous conditions.

There were many of these cases in New York at present. The distinguishing features were lethargy in all grades of encephalitis. This was an important and really infectious disease and the Neurological Society ought to do something as a body to study it. The speaker moved that a committee be appointed to get in touch with the Board of Health and make this a reportable disease, and also to go to the various hospitals and study these cases individually and in groups, and perhaps be successful in isolating the infectious agent, which was probably of the same nature or allied to the so-called influenza.

DISCUSSION

DR. WILLIAM LESZYNSKY said that he had seen a number of these cases of lethargic encephalitis accompanied by symptoms of polio-encephalitis and that the prognosis was favorable. He nevertheless approved the move to appoint a committee to study the condition.

BOSTON SOCIETY OF PSYCHIATRY AND NEUROLOGY*Regular Meeting, Jan. 17, 1919*CHARLES G. DEWEY, M.D., *Chairman, pro tem.***PESSIMISTS, PSYCHOPATHIC AND NON-PSYCHOPATHIC, SIGMUND FREUD, PESSIMIST: REVIEW OF "WAR AND DEATH."**

Presented by DR. E. E. SOUTHARD.

Dr. Southard gave a review of Freud's book, "War and Death," translated and published by Dr. A. A. Brill and Mr. A. B. Kuttner in 1918. He quoted from the translators' brief preface, "This book is offered to the American public at the present time in the hope that it may contribute something to the cause of international understanding and good will which has been the hope of the world," and then stated the thesis of the whole publication, "those who are not selfish and cruel are hypocrites. Selfishness and cruelty are the indispensable elements in man to which, repressed by civilization, we regress under the influence of war." Further quotations from the book were given, several of which follow: "Civilization is an illusion dashed to pieces by collision with a bit of reality." "States and races" have in the war "abolished their mutual ethical restrictions" so that they have been observed "to withdraw from the pressure of civilization." "Our conscience is not the inexorable judge that teachers of ethics say it is; it has its origin in nothing but 'social fear,'" and "civilization is based on hypocrisy." These quotations were introduced to throw some light on the philosophy of the author.

Dr. Southard then classified the great pessimists and optimists of history as follows, several of the names appearing in both lists because of the use of their teachings later by both groups:

MAJOR OPTIMISTS

Plato

STOICS

Leibnitz

Rousseau

Kant

Hegel

Darwin

MAJOR PESSIMISTS

Plato

EPICUREANS

Voltaire

Rousseau

Kant

Schopenhauer

Darwin

MINOR PESSIMISTS

V. Hartmann

Nietzsche

Freud

The speaker then took up the history of pessimism and spoke of the philosophy and psychopathic traits of a number of the great philosophers. He spoke especially of Rousseau, who maintained that man was naturally good but was rendered evil by culture and advocated the back to nature plan. This idea is the reverse of Freud's, who claims that man by nature is bad and can only hope for a little "sublimation" by the obscure processes of history.

An analysis of the book of "War and Death" was taken up from a purely philosophical point of view. Freud maintains that evil is the indestructible element in man and as an apologist for the war, Freud must be considered philosophically a pessimist. The book also is replete with quotations attempting to place the responsibility of the war equally on England and Germany.

The philosophy of Freud was then compared with that of Mrs. Eddy, as shown below.

EDDYISM	FREUDISM
Idealistic	Materialistic
Indeterministic	Deterministic
Optimistic	Pessimistic
Evil, illusory	Good, illusory
Forget	Recall
Spiritual and Absent Treatment	"Catharsis," intimate reeducation
Disease a delusion	Disease a flight from reality

Dr. Southard closed the discussion by asking if the American people will ever awake to the fact that pessimism—not militarism, devil worship—not soldier worship—is the philosophy and religion of Germany. He said that his point was not to show that Freud and Germans were psychopathic but that they were philosophically pessimists.

THE ARTERIAL TENSION IN MENTAL DISEASE. Presented by DR. CLAES ENEBUSKE.

The speaker gave a brief discussion of this topic. As long ago as 2500 B. C., the Chinese physicians noted the quality of the pulse, which we now designate as tension. For thousands of years pulse frequency and body temperature have been recognized as indices of disease.

In recent literature the usual designation of normal pressure ranges from 91 to 160 mm. of mercury. This, he said, varies considerably with the technic used. Observation of arterial tension in mental disease is as important as are observations of pulse rate and temperature.

The results of observations during fourteen years were given. He said that in 953 measurements of the arterial tension in twenty-eight cases of manic-depressive insanity, if the radialis arterial tension became spontaneously stabilized at 150 mm. of mercury, there would be neither manic nor depressive symptoms. In 5,046 measurements of the maximum radialis arterial tension in 130 cases of dementia praecox, if the tension became spontaneously stabilized at 150 mm., there were no evidences of praecox in acute or sub-acute state. In eighty-five cases of pulmonary tuberculosis, when the maximum tension of the radialis became spontaneously stabilized at 150 mm., there was no active tuberculosis present. These readings were made in all the major groups of mental disease. The feeble-minded show values closely approximating normal. The return to normal pressure in the manic depressive is much like the return of the temperature to normal after an infectious illness. He said that a spontaneously stable arterial tension of 150 mm. of mercury at the radial artery is the normal tension. Only an occasional case of dementia praecox recovers spontaneously a normal tension.

FATIGUE. Presented by DR. SIDNEY A. LORD.

Dr. Lord read the paper of the evening on this subject, remarking that the condition is omnipresent, the signs and warnings of its approach, the tokens of its arrival and the ear-marks of its existence are, or are supposed to be, plain as day. Yet very little attention is paid to it. Everyday matters, the necessary and inevitably constant activities of life are its begetters. We are wise in theories of fatigue but often not in practice.

The term as used clinically denotes conditions of widely different degrees of development and seriousness. As used by the reader, it denotes a normal state of diminished activity due to overactivity. Exhaustion designates over-fatigue, fatigue which has lasted longer than it would have, had rest been instituted and recuperation started at the correct time.

McKendrick, treating of the physiology of the cell in relation to its reaction to repeated stimuli, ventures the opinion that qualitative changes in the stimuli are not necessary to produce qualitative changes in tissue. The conception is that physical stimuli, repeated too often, too long, or too hard, may produce pathologic change. Prolonged stimulation produces phenomena which are quite foreign to the normal vital phenomena of the cell in question and all stimuli act primarily only as exciting or as depressing agents on the normal processes of life. This view accords with that held by Sherrington in his discussions of the physiology of the spinal cord and the principle of the final common path, for "if two conductors have a tract in common, there can hardly be any essential qualitative difference between their modes of conduction." Theoretically, then, pathologic states can be derived from normal conditions through increase in amount. The transition from normal fatigue to abnormal, from natural tire to exhaustion, is but one of imperceptible gradation.

The effects of fatigue are dissipated continuously. Doubtless there is great variation inborn in different individuals as to the rapidity with which they handle the fatigue products. It is also evident that toxic factors other than the fatigue products can work to the detriment of the cell.

Local and general fatigue were considered. Products generated in local fatigue may be taken up by the circulation and a general or distant reaction started. The reader referred to three types of fatigue; the mental, physical and moral and remarked that the more one studies the phenomena of fatigue in its broad applications, the more he becomes convinced of its power to produce widely distributed variations of function. Overstimulation of nerve cells experimentally is known to produce definite changes in the appearances of such cells; they shrink, the nuclei become smaller, the protoplasm takes on acid stains more readily than normal, etc. It is also true that basic as well as acid products are responsible for fatigue phenomena.

Clinically there is need in every case to ascertain the problem of fatigue in that particular individual as contrasted with his ability to stand activity. Fatigue should be given a first place in the consideration of the cause of disease, it should be in the foreground of the clinician's mind. Determination of over-use (over-much, over-long, over-quick) must be made.

The feelings of weariness, impaired capacity, gross physical fatigue, and altered behavior are signs of fatigue and call for attention. Normal fatigue as a human experience is elusive of definition; certainly there is a normal fatigue for a normal man. Normality of fatigue probably depends on the point of view. Normal fatigue should be pleasurable, a warning to rest *should* not be noxious to the mind. The products of fatigue are poisonous only in a restricted sense. The fluctuations of attention, the gradual loss of efficiency and capacity; distractibility, loss of discrimination, poor recollection and impoverished imagination are merely signs of oncoming fatigue and exhaustion and later are replaced by uncomfortable sensations and reduced functions which finally lead to pain and discomfort. The vegetative system takes part in the reaction also; the respirations become shallow, there are various external and visceral manifestations, irritability of the cardiac accelerator

mechanism, tachycardia, the "irritable heart" and neuro-muscular asthenia as seen in the war, etc. The exhaustion phenomena cannot be considered as a true neurosis. Such cases require careful study and treatment and unlike all fatigue cases, require gradually increasing exercises.

Fatigue in children is not sufficiently considered. Schools are standardized for average vitality but the standard of total accomplishments is too high; the pace on the whole is set by the strongest and others follow as best they can. Already, however, there is a trend of public opinion against the present system growing out of a recognition by educators and physicians of the fundamental dangers and faults of the present system. Classes in the schools should be divided according to fatigability of the children in line with the present mode of separation on mental grounds, and the schemes for testing efficiency in adult employment.

Many conduct anomalies can be ascribed to fatigue. In over-worked individuals, hard pressed by the stern demands of modern life, driven by the forces of circumstances, exhausted and fatigued, with loss of sleep, absence of opportunity to rest at will, worries necessitated by the struggle, normal character and behavior responses are hardly to be expected. With loss of health a possibility, with the power of recuperation slipping away, with capacity and efficiency diminished, the morbid state can well be appreciated and the inevitable result points toward the formation of conflicts.

The recognition and appraisal of such conditions is not easy. Laboratory tests are not available and are too time-consuming to be of value. Pains-taking examination to determine the amount of fatigue present is the only feasible way. Tests for cardiac and muscle fatigue are available, to be sure.

The treatment of the cases is variable, some individuals require complete recovery every twenty-four hours or they decline. The accumulative effects of fatigue may go so far as to make recovery doubtful. There is even danger of pushing too hard without evidences of fatigue arising, especially in conditions associated with the psychic drive. The necessity of complete recovery from fatigue each day was strongly emphasized. Regulation of activity itself is important, the intensity of work, the speed with which it is done, etc., call for consideration of those interested in the plan of conservation. In health, feelings and sensations may be true guides to conduct but surely in disease, they cannot be considered. An attempt should be made to regulate activities so as not to produce fatigue. Inability to sleep may itself be an evidence of exhaustion—an abnormal fatigue.

BOSTON SOCIETY OF PSYCHIATRY AND NEUROLOGY

Regular Meeting, Feb. 20, 1919

GEORGE A. WATERMAN, M.D., *President*

NON-DEMENTIA NON-PRAECOX: A NOTE ON THE ADVANTAGES
TO MENTAL HYGIENE OF EXTIRPATING A TERM. Presented
by DR. E. E. SOUTHARD.

Dr. Southard said that there were some people who chose to take away all terms that were not useful, surely there are many terms that are not exact. Probably the worst term we have in psychiatry is "dementia praecox," no one disagrees as to its badness. Kraepelin has been noted for the poor terms he has introduced and a priori, this term, which Kraepelin suggested,

should be bad. The reader said that some international committee on psychiatric terminology should be formed to select desirable nomenclatures.

In dementia praecox, neither dementia nor precocity in any sense are necessary. It is a term that brings much unhappiness to patients on whom the diagnosis is made and much wrong results from its use. It should not be used just as syphilis should not be diagnosed as such because of the harm done, though every one knows its relationship to general paresis. It is hard to label dementia and it does not have to be present in dementia praecox.

Catatonia was first described in 1858. Kraepelin in 1896 synthesized several types of mental disease into the dementia praecox group. In 1913, he evolved thirteen types which he designated as endogenous deterioration and in the group were nine types of dementia praecox and four of paraphrenia. Blueler has later suggested the term schizophrenia and it should be used instead of the undesirable one, dementia praecox. It is a good root for various derivations and conveys the idea which is most important in the disease, splitting of the personality. Its use does not commit one to any notion of the mechanism involved nor to any theory of the nature of the process. So far as he knew, there was no objection to the term replacing dementia praecox in clinical work or statistics and much to be said in its favor.

DISCUSSION

DR. E. STANLEY ABBOT said that the term dementia praecox was quite undesirable, but the fact remains that many of the cases do go on to dementia. He recognized the danger to an individual of having the diagnosis made on him, but errors in diagnosis should not be sufficient reason for removing a term. That very feature rather tended to develop care in making the diagnosis and necessitated the more clear definition of symptoms and more care in making the diagnosis. Science develops by delineation, not by substituting terms. He felt that no advantage could be gained by substituting schizophrenia for dementia praecox, for the former has a connotation far wider than the latter. What is desirable is to have a term which designates those who do not dement from those who do. Moreover, the mere diagnosis is of secondary importance, for one should attempt to do all he can for a patient even though the diagnosis of dementia praecox has been made.

A CASE BEARING ON THE JAMES-LANGE THEORY OF THE EMOTIONS. Presented by DR. A. MYERSON.

Dr. Myerson discussed a case bearing on the James-Lange theory of the emotions. The James-Lange theory of the emotions, in contra-distinction to the Introspectionist and Intellectualist schools, states that the essential features of any emotion are its bodily manifestations. One feels sorry, according to the theory, because he weeps and is afraid because he runs away.

The case discussed illustrated the fact that feeling itself may be absent from consciousness. The patient cries and laughs without being either sad or glad; though she weeps, she does not feel sorry; though she laughs, she does not feel happy. In addition to the absence of emotions, the fundamental organic sensations—fear, anger, hunger, thirst, sex desire and fatigue—were absent. Psychic pleasure and pain also were not present though absence of these feelings was recognized.

The patient was a single, Anglo-Saxon woman of 32. The family history was negative; early life uneventful. She had always been "nervous," temperamental and sensitive. She was artistic and emotional. After a love affair at 25, the patient returned to her home in Georgia and suffered a "nervous prostration," characterized by easy fatigability, "hysterical" attacks, seclusiveness, depression, introspection, headaches, etc., and later she became delirious and confused. Since then she has known no affection, no patriotism, no emotional pain.

Physical examination was negative. She impressed the examiner as over-emotional, judging from the face, voice, laughter, tears, respiration, etc.; objectively she seemed emotional. But she had no sense of hunger, fatigue, thirst, sleepiness; she eats, drinks, rests, sleeps out of pure force of social custom. She showed every reaction to fearful circumstances, but never experiences fear. The pleasures of anticipation and realization of activity and relaxation, the things which give variety, color and joy to life have disappeared. No evidences of any psychosis were present. It seemed unlikely that she pretended to have no feeling or that she was attempting to deceive herself.

The changes of emotion are conspicuous in hysteria, manic-depressive, the psychoneuroses (the "anhedonia" of Ribot), in some phases of dementia praecox, in organic brain disease involving the basal ganglia and the type of case here noted. What seems important is that the emotional expression seems reflexly excited by the environment with adequate conformity of conduct but without feeling resulting. This case evidently is one of permanent dissociation of affectivity from the other links of emotion.

DISCUSSION

DR. DONALD GREGG raised the question as to whether the features in this case were not analogous to those seen in fatigue and in some cases of habit alone. The conditions here might be likened to an artificial anesthesia, affecting especially the emotional sphere.

UNIFORM STATISTICAL REPORTS ON INSANITY NOW ASSURED. AN OFFICIAL CLASSIFICATION OF PSYCHOSES. Presented by DR. JAMES V. MAY.

The speaker said that psychiatric progress has been hampered by an unfortunate absence of accurate scientific information on which to base deductions regarding the mental diseases. We find ourselves overwhelmed with theories of these diseases and confronted with a startling absence of established facts. Psychiatric problems are voluminously discussed by some even widely recognized writers whose actual knowledge of the care and observation of insane patients has been insignificant, or derived from sources long since considered inaccurate. Personal opinions are often advanced as facts. Textbooks are filled with unsubstantiated statements about the frequency of various forms of insanity and the recovery rate of the different psychoses, derived from personal observations or the statistical data of single hospitals. Only by general and accurate statistical studies can we arrive at conclusions of value in these matters which are so important for the proper development of psychiatry.

The etiology of insanity has long been a matter of discussion. Well known authorities widely disagree. Heredity is looked on as one of the most important factors and it probably is. But to just what extent it is responsible in the various psychoses can only be learned by careful statistical studies. The part played by the mendelian ratios requires investigation. The importance of mental defects and insanity as related to criminality, prostitution, alcoholism and pauperism is now generally accepted. But just the extent can only be learned by careful statistics. The infrequency of psychoses due to single drugs is remarkable, but few reliable figures are available.

Our knowledge of the epileptic psychoses is perhaps the most discouraging of the problems of psychiatry. We know that nervous and mental diseases, feeble-mindedness and alcoholism are prominent in the family history of epileptics. Attention has been called to the so-called "epileptic constitution" by L. Pierce Clark and others. There is no satisfactory classification of the epileptic psychoses. In many of them, there are associated psychoses which are incidental to the epileptic features. To clarify this confusion, accurate statistics, carefully and accurately analyzed, must be obtained.

There is very little reliable data relating to the psychoneuroses. Constitutional psychopathic inferiority is now recognized by the government as an adequate reason for rejection of immigrants. The relation of this condition to the psychoses is very little understood. Information at present available on the frequency of different forms of psychoses and their recovery rate is almost useless. The peculiarity of certain of the psychoses to certain races, communities and stages of life has long been emphasized. The facts of such claims are still to be demonstrated in many instances. An analysis of the 200,000 and more cases in the institutions of this country according to one standard would help much to settle some of these problems.

The cost of the care and maintenance of the insane is in itself a question of importance and legislative investigations of this matter are frequent. Some states include cost of repairs and improvements in the cost of maintenance, some deduct all receipts for reimbursing patients, others take into consideration the value of articles produced in the industrial departments and the value of farm products. Discrepancies in the per capita cost of the various hospitals are often merely matters of book-keeping.

Correlation of the statistics of different states has been difficult owing to the multiplicity of methods of administration, some states having central control, others having none. In some states the control is vested in commissions; in others, the control is held by the State Board of Charities, etc. The statistics submitted by each organization have followed no uniform classification of mental diseases and chaos has been the result.

Repeated efforts to correct this situation have been made. At the annual meeting of the American Medico-Psychological Society in June, 1913, a committee was formed to draw up a plan for compilation of data on the insane in the institutions of the United States and Canada. This committee reported at the meeting in 1917 a set of tables and classification of mental disease to be used by all the institutions. Since the official adoption of these statistical tables, the Association's committee has prepared an elaborate manual explaining their use, intended to explain any questions which may arise in connection with the use of the classification or the statistical tables.

Dr. May read excerpts from the report of the committee and read the classification of mental diseases as adopted and which are given in the manual (only the main headings are given below; the complete classification is given

in the manual, which can be obtained from the National Committee for Mental Hygiene, 50 Union Square, New York).

1. Traumatic psychoses.
2. Senile psychoses.
3. Psychoses with cerebral arteriosclerosis.
4. General paresis.
5. Psychoses with cerebral syphilis.
6. Psychoses with Huntington's chorea.
7. Psychoses with brain tumor.
8. Psychoses with other brain or nervous diseases.
9. Alcoholic psychoses.
10. Psychoses due to drugs and other exogenous toxins.
11. Psychoses with pellagra.
12. Psychoses with other somatic diseases.
13. Manic-depressive psychoses.
14. Involutional melancholia.
15. Dementia praecox.
16. Paranoia or paranoid conditions.
17. Epileptic psychoses.
18. Psychoneuroses and neuroses.
19. Psychoses with constitutional psychopathic inferiority.
20. Psychoses with mental deficiency.
21. Undiagnosed psychoses.
22. Not insane.

The practical operation of this plan has been assured by the establishment of a Bureau of Statistics of the National Committee for Mental Hygiene, and their work is coordinated with a similar committee of the American Medico-Psychological Society. The commissions and central boards of control in a large number of the states have adopted this classification. Of the 156 state hospitals for the insane in the country, 145 have adopted the plans.

The success of this important movement appears to be definitely assured and unquestionably constitutes one of the greatest developments of modern psychiatry.

DISCUSSION

DR. E. E. SOUTHARD said that there had been much criticism of the classification of mental diseases as adopted and presented by Dr. May. He was much displeased by it. But it was the best that could be developed at the time and has brought some form of agreement out of the previous chaos and does mark a definite step in the right direction. Provisions have been made to attend to all changes which, in the light of future developments, may be necessary and the present scheme does form a good working basis. He said that many people do not distinguish between a terminology and a classification. The proposed grouping of the diseases is a classification. The errors in the plan are those of omission rather than commission and can readily be adjusted in time.

DR. E. STANLEY ABBOTT, a member of the committee which framed the classification, said that the entire committee was dissatisfied with the results of their work but that they had adopted compromises and finally drew up the classification which seemed to be the most satisfactory for every purpose. It seemed to be workable and as such was submitted. Some classification is needed if accurate statistical data is to be collected; from the plan submitted

the most comparable data could be collected. The classification is far from final, and the purpose of a standing committee was to take care of all suggestions made which aimed at improvement of the scheme.

DR. H. B. HOWARD said that all classifications were the result of compromises, and for that reason do not satisfy every one or any one. But they may still form a good working basis for statistical studies. He said many criticisms arose from those who had not familiarized themselves with the aims of the classification or the keys to be followed; it is important to study the manuals of classification before one criticizes their contents and aims. One very good feature of the present plan is the establishment of a permanent committee to attend to points of controversy and amplification as time goes on.

**PROPERTY
MASS. COMMISSION
ON MENTAL DISEASES
PATHOLOGIST'S OFFICE.**

Archives of Neurology and Psychiatry

Vol. I

JUNE, 1919

No. 6

PATHOLOGY OF EXPERIMENTAL TRAUMATIC ABSCESS OF THE BRAIN *

CHARLES R. ESSICK, M.D.

Captain, M. C., U. S. Army

READING, PA.

In civil life, bacterial invasion of the brain resulting in the formation of an abscess, occurs relatively infrequently. Such lesions usually follow as a slow extension from a septic process in the neighborhood of the brain and only reach it after erosion of bone and the heavy connective tissues of the meninges. The development may involve weeks or years. It is fortunate that the central nervous system is so well protected from invasion, as the septic injuries of the brain are the most distressing wounds that a surgeon has to handle. During active warfare, on the other hand, the number of such casualties is enormously increased, and this study was begun with the hope of improving the treatment of these cases. Unfortunately, such a program has been but partially carried out and the work here presented represents the histologic control of the experimental traumatic abscesses of the brain.

The first part of the program undertook the study of the repair of aseptic wounds of the brain. This phase of the work was a repetition, on a limited number of animals, of the many similar experiments that have been carried on in other laboratories. Later a large number of animals (thirty-five) were subjected to varying types of infected injuries to discover, if possible, some of the general principles underlying the spread of infection and the factors governing the rate of spread. In every instance the dura was perforated; but the method or the details of infections were varied. Parts of the cortex were scooped out; perforations communicated with the lateral ventricle in some instances, while in others they only slightly injured the most superficial layers of the brain; foreign bodies of bone or metal were introduced into the wound; the skull was fractured in some instances along with the puncture of the central nervous system. In a word— attempts were directed toward reproduction of the wounds received at the battle front.

*From the Army Neuro-Surgical Laboratory, Johns Hopkins Medical School, Baltimore.

EFFECTS OF BRAIN INJURY

It is important to recognize from the outset that an acute traumatic abscess differs in almost every respect from a lesion developing by slow extension. The rapid spread, with its fatal termination in a few days, as well as its healing by the formation of a connective tissue scar, presents an entirely different picture from the slowly growing process with a distinct tendency toward sequestration by forming a thick connective tissue capsule. The reasons for such differences are not to be sought in the kind of infection, the virulence of the organism, the kind of defensive mechanism employed by the affected part, or its anatomic position, but rather in the effect of the *injury* itself. Injuries involving the central nervous system at once cause a profound alteration in the normal circulatory and drainage mechanisms of the brain. The expression of such changes is swelling, or edema, and we have the beginning of a vicious circle, which takes but hours to be set in full motion. Long before anything which could be looked on as an adequate interference with bacterial growth has been instituted, the tissue is made more susceptible by anemia and edema. It is the surgeon's chief problem when operating on the slow eroding abscess of extension, to avoid exciting by trauma the phenomena of swelling and edema, and thus producing a rapidly fatal extension of the process.

The literature on brain abscess is clouded by the use of terms of which the exact meaning is not always clear. The susceptibility of the highly specialized nervous tissue to modifications of the vascular system, which might be inconsiderable in other parts of the body, opens up an easy field for softening and necrosis. It is to these processes that much attention was given in the older literature with efforts to establish their relation as fore-stadia to inflammation. These softenings were usually included under three heads — red, white, and yellow, according to the color seen at gross necropsy. The first two depend on the relative amounts of blood in the outer zone of the abscess; the more common red softening being the result of extravasated erythrocytes and vascular dilatation; while the white softening follows the anemic conditions and is more often associated with thrombosis of a vessel. The yellow, sometimes brown, softening is an older stage of the red softening and results from the breaking up of red cells into various oxidation products of hemoglobin.

The term "encephalitis" itself seems to be simple and straightforward enough, yet it suffers confusion with "inflammation," particularly within the central nervous system where vascular reactions are so greatly modified. It is repeatedly discussed in its relationship to red softening in a way that seems to cloud rather than clear the con-

ceptions. The cause of the confusion is unquestionably attributable to the fact that our knowledge of the encephalitides is mainly classified after study of clinical history and resting very little on pathologic findings under the microscope. Our knowledge of the actions of toxins on the nervous system is very incomplete, but it is here that the key to many of our difficulties lies. The relation of abscess to encephalitis is described by Oppenheim,¹ as follows:

Es gibt Encephalitiden, die mit dem Hirnabscess nichts zu thun haben, nicht in denselben übergehen. Es gibt ferner eine haemorrhagische Encephalitis, die sich mit einer suppurativen verbinden, respective in dieselbe übergehen kann (durch secundaere Infection). Dies gilt z. B., für die traumatische. Der Hirnabscess entsteht wahrscheinlich meistens in der Weise, dass von vorneherein zur Eiterbildung kommt; jedenfalls ist es nicht bewiesen, dass dem Stadium der Suppuration ein anderes voraus zu gehen braucht, in welchem das anatomische Bild sich mit dem der "rothen Erweichung" deckt.

The use of these terms has been purposely avoided in an attempt to introduce as little confusion as possible into this paper.

Experimental work on the central nervous system has been largely directed toward the simple repair of the brain lesions under aseptic conditions with a view toward establishing the part played by the various cellular elements—fixed and foreign—in the reestablishment of an equilibrium. The earliest researches were concerned with the ability of the nervous tissue to regenerate. The ganglion cells, for the most part, play a passive rôle and show but a feeble effort to replace destroyed elements. Their nuclei may show a preparation for mitotic division, but there is little evidence that this division is ever completed normally. The same holds true for the regeneration of the axone, within the central nervous system, when once the continuity of the latter is broken, nothing comparable to the replacement in a peripheral nerve ever occurs. The neuroglia cells are found to play a very important part both in inflammation and repair of the brain.

The best work on simple wounds of cortex was carried out in Ziegler's laboratory by Tschistowitsch.² To prevent the inflammatory factors from complicating the histologic picture of repair was his chief aim, and his choice of foreign body (small celloidin tubes kept sterile in alcohol) seems most fortunate, in that it produced practically no tissue reaction in the brain. He found that the nervous elements of the neighborhood made no attempt to reproduce the loss. The glia

1. Oppenheim, H.: Die Encephalitis und der Hirnabscess, Nothnagel's Specielle Pathologie u. Therapie, Wien. 9: 1903.

2. Tschistowitsch, Th.: Ueber die Heilung aseptischer traumatischer Gehirnverletzungen, Ziegler's Beiträge 23:321 (2 plates), 1898.

cells swelled up, divided actively — probably as a result of the change in nutrition. Tschistowitsch has no proof that they add to the host of phagocytic cells which digest and remove the destroyed tissue, but he does not conceive it impossible. He believes the phagocytic cells to be derived from connective tissue cells of the pia and from the adventitia of the penetrating vessels, partly from endothelial lining of blood vessels and leukocytes. The substitution of lost parts is made almost entirely by connective tissue. Within a few days the young fibroblasts derived from the pia mater may be seen wandering into the wound edges with their long axes parallel to the axis of the lesion. Side by side grow new vessels. The connective tissue growth was much less in wounds produced by introduction of celloidin tubes. The glia takes no part in the formation of the cicatrix which replaces the destroyed elements, but merely confines itself to the elaboration of a secondary zone of sclerosis around the scar. The sclerosis varies in amount with the duration of the original stimulus.

The activity of the neuroglia in inflammation as well as in normal conditions has been elaborated on by Alzheimer.³ He postulates two kinds of neuroglia cells, indistinguishable from one another, which exist as a normal supporting reticulum. Those of the first type are essentially part of the fibrillar network and they are solely occupied with the maintenance of this network. A second variety may easily free themselves and become ameboid. This group, under the stress of great degenerative processes, takes on special forms, assimilates degenerated products, and carries them to the perivascular spaces. Thus they may contribute to the large phagocytic mononuclears seen in close association with the brain abscesses.

RELATION OF MACROPHAGE TO ABSCESS

The most striking characteristic of destruction of the nervous tissue is the appearance of these large mononuclears. In 1841, Gluge⁴ called attention to *Körnchenkugeln* as a diagnostic point in inflammations of the central nervous system. These were collections of *Körnchenzellen*, about which all subsequent discussions concerning inflammatory processes in the brains revolved for the following half century. Virchow⁵ described an "encephalitis neonatorum" in which he regarded

3. Alzheimer, Alois: Beiträge zur Kenntnis der pathologischen Neuroglia und ihrer Beziehungen zu dem Abbauvorgängen im Nervengewebe, *Histol. u. Histopathol. Arb. über Grosshirnrinde* (Nissl), Jena 3: 1910.

4. Gluge, G.: Experimente über Encephalitis, *Abhandlung z. Physiol. u. Path.* No. 2, Jena, 1841, p. 13.

5. Virchow, R.: Kongenitale Encephalitis und Myelitis, *Virchow's Arch.* 38:129, 1867.

the *Körnchenzellen* as a product of a fatty metamorphosis of neuroglia cells.. Hayem⁶ looked over twelve supposedly normal new-born brains and found granular cells (*Körnchenzellen*) which he took to be the normal appearance at that period of growth. In 1871, Jastrowitz⁷ demonstrated their presence in children's brains unquestionably normal because they were dead only as a result of accident at birth. In addition he proved that there was an apparent irregularity of distribution. He noted the greater number of these cells to occur in these areas where fibers were developing more rapidly than in other regions of the brain — "besonders stürmischen Entwicklungstypus." He thought them of glial origin. Boll⁸ identified them in normal chick embryos at from twenty to twenty-one days of incubation, and found them extremely ameboid on the warm stage. He believed that they brought fat for the deposition of myelin on the axis cylinder. Flechsig⁹ completely correlated their distribution with the time of myelinization of the fiber tracts, yet he was unwilling to commit himself as to their origin, but inclined toward a view that they were glial. The microchemical work of Wlassak¹⁰ solved the discrepancies which gave rise to so many diverse interpretations. On the one hand, the followers of Virchow regarded these granular cells as degenerative in character and consequently to be viewed as pathognomonic of inflammation. On the other hand, Jastrowitz and his followers believed their occurrence was a normal physiologic event, especially when associated with early development. Chemical analysis proved both of their views correct although the controversy had lasted for many years. Granules in cells, then, could be lecithin, protagon, albumin, decomposition products of hemoglobin, fat, and so on. With this conception, the cells previously grouped as "*Körnchenzellen*" have been variously subdivided, according to the conception of the author as to origin, morphology, or physiologic activity. The more recent literature has become more and more interested in the function and activities of cells and less with exact morphology. Such interpretations are open to the possibilities of greater mistakes, but also allow a more intelligent effort toward control of cellular reactions in inflammation and repair.

6. Hayem, G.: Etudes sur les diverses formes d'encephalite, Paris, 1868.

7. Jastrowitz, M.: Encephalitis und Myelitis des ersten Kindesalters, Arch. f. Psychiat. **2**:389, 1870; **3**:162, 1872.

8. Boll, Fr.: Die Histologie und die Histiogenese der nervösen Zentralorgane, Arch. f. Psychiat. **4**:1, 1874.

9. Flechsig, P.: Die Leitungsbahnen im Gehirn und Rückenmark des Menschen, Leipzig, 1876.

10. Wlassak, W.: Die Herkunft des Myelins, Arch. f. Entwicklungsmechanik **6**:453, 1898.

Among the writers of the last decade are found Nissl¹¹ and Mertzbacher¹² who have attempted to read activity into the processes of destruction and repair, each from slightly different points of view. The experimental work of Nissl has served to emphasize the "Gitterzell" as a pure and simple phagocyte whose chief rôle is the restoration of order after a destructive process has set in. The granular cells should no longer be looked on as a specific element in inflammation, for they are quite often the cells wholly concerned with reparative process. They appear in every situation where necrotic tissue-masses (foreign bodies) must be removed. If one chances on these cells at some distance from the lesion within the perivascular spaces, more than likely they have come from the focus of infection, laden with waste products and are making their way into the channels of tissue-drainage.

Mertzbacher wishes to reclassify these cells seen in inflammation into a physiologic group and ignore their origin entirely. His term "Abräumzell" suggests a purposeful activity and includes both "Aufbauzell" and "Abbauzell." In this sense it is better than the physiologic term "Macrophage," but the latter is probably doomed to stay because of its priority. The term "Macrophage," proposed by Metschnikoff, refers only to the power of the cells to phagocytize large elements. The functional division made by Mertzbacher was between physiologic and pathologic cells—the normal physiologic "Körnchenzell" of the embryonic central nervous system (clearly an "Aufbauzell") belongs to the group of cells known as "Abräumzell of the adult.

Friedmann¹³ published many papers on his experiments on encephalitis, emphasizing the importance of the epithelioid cells. His conceptions and observations seem in no way to have contributed to the solution of the problem.

THE WALLING-OFF PROCESS

The question of greatest interest to the surgeon has always been the walling-off process. Where the invasion is slow, the fibroblasts lay down a very efficient barrier of connective tissue ahead of the infection. The time necessary to bring about the protective barrier has been variously estimated, and the lower limits necessary for its formation have been the subject of much discussion. The knowledge

11. Nissl, F.: *Zur Histopathologie der paralytischen Rindenerkrankung*, Histol. u. Histopathol. Arb. über Grosshirnrinde 1:315, Jena, 1904.

12. Mertzbacher, L.: *Untersuchungen über die Morphologie und Biologie der Abräumzellen im Zentralnervensystem*, Histol. u. Histopathol. Arb. über Grosshirnrinde (Nissl) 3:1, Jena (7 plates), 1909.

13. Friedmann, M.: *Encephalitis und Hirnabscess*, Handbuch der Pathol. Anat. des Nervensystems (Flatau-Jacobsohn) Berlin 1:494, 1904.

gained from aseptic wounds helps us but little. There the young fibroblasts may be seen on the fifth to sixth day, taking active part in the repair, but in no sense can they be looked on as capable of resisting the spread of an infection. The differences of opinion are largely the results of inability to absolutely demonstrate true connective tissue fibrils. Preceding the actual fibril formation, a collagenous material is laid down, and this takes a progressively deeper stain, similar in character to the finished connective tissue.

This process of repair in a sterile wound is in no way comparable to the formation of a protective wall in an abscess. The latter forms in the intermediary zone between the living and dead tissues, attacked on one side by the toxins and supported on the other by a very much impaired circulation. The fluids bathing the young fibroblasts which wander very early into the outer zone of the abscess are certainly very different from those present in a sterile destruction. It is generally conceded that an adequate connective tissue barrier forms very slowly. Observers have made various estimates from clinical history, namely, Lebert, from 3 to 4 weeks; Schott, from 7 to 8 weeks; R. Meyer, 7 weeks; Gull, 10 weeks; Huguenin, 53 days a thin membrane, 83 days a thick resistant wall.

The lowest estimate in these figures shows the utter hopelessness of waiting for such a fibrous barrier to help us in treating a traumatic infection of the central nervous system. Furthermore, it must be remembered that, were its formation possible, it would be of doubtful value when one considers that the completely encapsulated process slowly encroaches on the healthy tissue owing to toxic products seeping through the capsule, through pressure, or through vascular changes. It may be repeated that the traumatic abscess is something different from the encapsulated variety and by careless handling the latter may be transformed into the former. The infection in the brain spreads so rapidly after an injury that there is no time for the interposition of a connective tissue barrier, and a rational treatment can never hope to receive aid from such a slow and really ineffectual mechanism.

METHODS EMPLOYED IN EXPERIMENTAL PRODUCTION OF TRAUMATIC ABSCESES

It was early discovered that an abscess in the brain of a cat developed with great uncertainty unless a positive—what might even be called a massive dose of bacteria was introduced into the wound. Simple puncture wounds often healed *per primam* although no efforts were made to sterilize the instruments or tract. An animal's resistance to infection, even after rupture of the dura, was found to be quite remarkable. There seemed to be little tendency

for organisms to grow down into the brain from the skin, or for the few carried in with the instruments, to gain a foothold. In order to inaugurate an infection, an injection of from 0.1 to 0.3 c.c. of bouillon culture or pus in varying dilutions was made into a wound. The ordinary pyogenic organisms cultured from human infections were found to be very feeble in virulence. Pure cultures of bacteria obtained from abscesses in cats proved to be more efficacious. The most rapidly fatal lesions were produced by taking pus from a cortical abscess of one cat and injecting it directly into the brain of another. Some of the animals treated in this way survived less than twenty-four hours. Not uncommonly a spread along the whole track of the wound instituted a cellulitis within the scalp. Such secondary complications were treated by evacuation as soon as they developed, but at times the subcutaneous infection would spread over the entire head and as far forward as the eyes. The cats within this series were not all normal when the experiments were started, often having been used for other observations on the central nervous system. Such a past history often changed the course of the abscess as well as the cellular reaction of the host.

A nail of given length was sharpened for making perforating brain injuries and a known weight was put behind it; this was then allowed to fall a definite height. The method was quickly abandoned because of the uncertainty of getting a standard wound. The principal difficulty lay in the rotundity of the cranium. Blows administered in this manner tended to be deflected so that considerable subcutaneous trauma might be inflicted without perforating the skull. In one experiment a piece of infected copper wire was forced into the brain substance through the nail hole. Another method employed was to remove a cylinder of the skin, skull, dura and brain, and to place infected foreign bodies in the defect. Such a procedure at times reached the lateral ventricle, more often the infection did not start within the ventricular system. A trephine was used for the skull and a cork borer to remove soft parts.

The greater number of experiments were so made that there was no room for expansion of the brain. A bluntly sharpened instrument, 1 mm. in diameter and provided with a shoulder so that it could only be inserted to a depth of 6 mm. from the surface of the skin, was used to make an opening for a hypodermic needle. Such wounds caused little or no trauma to the subcutaneous tissues and were just sufficient to penetrate the outer zones of the cortex. Rarely this struck a sulcus and the syringe needle actually ended in the subarachnoid space without penetrating the cortex. At necropsy such failures were indicated by a purulent meningitis without involvement of the brain. The quantity of diluted pus or bouillon culture used was sufficient to cause a localized rupture of the tissues accompanied by slight hemorrhage. In every case an initial spread of the injection mass into the subarachnoid spaces was unavoidable.

A few attempts were made to completely localize the infection to the point of inoculation by injecting the septic material into the exposed cortex through a trephine hole and immediately sterilizing the surface. The results of such a procedure were very disappointing as they were just as susceptible to a meningeal spread as were animals treated similarly without sterilization. Attempts were made to cure the experimental abscesses either by trephining and draining, or by trephining and irrigation. The number of attempts was

so small that no conclusions could be drawn. Actually, the number of spontaneous cures was greater than the number following attempted therapy.

CLINICAL HISTORY

Little importance can be attached to this part of the work in animals. Often, when the virulence of the infecting agent was low, the animal behaved as if normal for a day or two. On the other hand, with more virulent strains injected with pus, the protocols show that the cats were sick immediately after the experimental injection. Following concussion or cortical ablation the animals were dazed or showed little desire to move or eat; at such times there was a definite weakness in the hind legs but no actual paralysis. After considerable trauma they might be unable to walk or crawl, but these reactions should not be considered in any differential diagnosis concerning the type of lesion. The history of the present illness would be enough to account for the reaction. No attempt was made to record temperatures as there is so much variation under the condition of experimentation. After simple perforation the element of trauma was minimal, and the record of "quiet" or "less active than normal" would be the only signs of disturbance. The discharge of pus from the wound gave absolutely no clue as to the process developing within the cortex. As a matter of fact, this hole in the bone was very quickly sealed by granulation tissue and the subcutaneous reactions had no effect on the cortical infection. Very few of the cats were sacrificed but were allowed to die spontaneously. The animals included in the end of the series were often found dead in less than twenty-four hours after inoculation.

PREPARATION OF MATERIAL

The animals were embalmed as soon as possible after death by injection of 10 per cent. formalin through the aorta. A block including the skull and cervical vertebrae was then suspended in the same fluid until ready for study. The relations of the meninges to the bone were studied and gross macroscopic descriptions were recorded and the tissues were embedded in celloidin. Hematoxylin and eosin, toluidin blue, Van Gieson, and Mallory's connective tissue stain were applied to the sections. It is evident that such technic precludes a study of the finer cellular changes in the nervous system, but it preserves the intracranial topography and does not interfere with observations of the cellular reactions.

MACROSCOPIC APPEARANCE OF BRAIN ABSCESES

The central nervous system, as usually seen at necropsy, gives little exact knowledge of the relations obtaining at the time of death. Dislocations and changes in shape due to pressure are largely lost when the soft brain is taken from the skull. By injecting formalin into the aorta at death and fixing thoroughly by immersion, all of the gross form relations are preserved. The changes in the size, shape and position of the ventricles are maintained faithfully and any distention of the leptomeninges by fluid-accumulations is undisturbed. Unless such fluid in the subarachnoid space is coagulated by fixation,

its appearances of distention are largely lost if the meninges are not hardened in situ.

The most striking change produced by these traumatic abscesses was the increased tenseness of the brain. This showed itself most markedly by a herniation of the subjacent nervous tissue through a defect in the dura and skull. Whole gyri were capable of slipping out when the hole was large enough, taking with them a fairly intact blood supply. Such protrusions rapidly underwent necrosis in the central portions and were sloughed off. The most rapid expulsion of nervous tissue followed the simultaneous development of a subdural abscess away from the dural defect, and this greatly added to the fungus which developed as a result of increase in size of the brain itself. Palpation of such a brain revealed an unusual tenseness, and any splitting of the dura due to careless removal allowed the brain to bulge out. The evidence of swelling might extend down the cord where the markings of the intervertebral spaces could be seen in outline. On the dorsal surface of the cord these segmental corrugations were often great enough to be felt by running the fingers up and down the unopened dura. The result of the swelling was to partially obliterate the sulci of the brain so that they appeared as mere lines when viewed through the dura. Such conditions might still exist at the end of a week. The effects of swelling were usually more marked on the affected side, but they might involve both cerebral hemispheres equally. The macroscopic evidences of meningeal infection, hyperemia and petechiae, clouding of the normal markings and heavy purulent exudate, showed considerable variation. In six of the experiments, no evidences of an inflammation spreading beyond the point of injury could be demonstrated macroscopically. In seven instances, there was a progressive advance of the process over the injured hemisphere with the formation of a heavy purulent exudate which completely obliterated the brain markings on the affected side. There was a distinct tendency to stop at the midline along the falx cerebri (Fig. 5), and to spare the temporal pole and the occipital lobe. Another peculiarity of distribution, in two experiments, was a normal looking cerebrum surrounding the injury with no macroscopic evidences of meningitis over the brain; the cord, medulla and cerebellum, on the other hand, were totally obscured by a thick layer of yellowish exudate. In these instances either by direct injection into, or subsequent invasion of the lateral ventricle, the ventricular system became the pathway for an extension of the infection to the natural outlets to the subarachnoid space—the foramina of Magendie and Luschka. At these points the process attacked the meninges spreading over the hind brain and

down the cord. In fifteen of the thirty-five animals, a generalized meningitis was present at death. Where only a small opening existed in the skull and there was no chance for the nervous tissue to herniate, the defect was filled with a plug of coagulated debris which quickly began to organize. Some of the injuries were very close to the mid-line and an opening was made into the large vein emptying into the sagittal sinus. This was followed by a hemorrhage which almost completely covered the cerebral hemisphere, extending to the base of the brain and out along the rhinencephalon.

On section, the gross specimen showed remarkable changes in brain-bulk, which brought about extensive dislocation of the entire brain, especially where the lesion developed rapidly within the normal confines of the skull. The affected hemisphere might occupy one-third again as much space as the unaffected one, enlarging at the expense of the latter (Fig. 10). This encroachment of the injured side was greatest at a point midway between the vault and the base of the skull. At these fixed points the nervous tissue was anchored by the meningeal vessels, and had no opportunity to be displaced. The result of this was a curved midline with the convexity looking toward the unaffected side. The transverse section through the lesion showed the greatest changes, but the entire affected hemisphere might bulge beyond the normal limits (Figs. 10, 11). As long as the brain herniated, as in a decompression (Fig. 19), the normal appearance of the mid-line was unaffected. Here the local increase of brain-bulk took the line of least resistance and instead of compressing healthy brain tissue, release was afforded by protrusion from the skull.

Another effect of increase in size of the brain was the encroachment on the spaces ordinarily filled with cerebrospinal fluid. Such a condition arose in most of the experiments included in this series, because the abscesses developed within the intact skull. The gyri were forced together and the normal subarachnoid tissue between them was compressed until it appeared as a mere linear slit. The normal, rounded gyrus was flattened out against the dura and the contour approached a straight line with the sulci meeting it at right angles. It is conspicuously shown in Figures 11, 16 and 18. The reactions of the ventricular system were very definite. They were complicated by infection in eighteen instances, of which three were unquestionably inoculated at the very beginning of the experiment, whereas fifteen were infected by extension of the process into it. Whether invaded or not, there was present, in nearly all of the experiments, a tendency toward the production of a slight grade of hydrocephalus (Figs. 8, 10

and 11). If the ventricle was perforated by the original injury, the entire ventricular system rapidly dilated with pus (Fig. 18) forming a pyocephalus of moderate grade. Where the original abscess eroded its way into the ventricle, the latter was soon filled with a purulent exudate on the affected side. The contralateral ventricle was likewise distended, but as a rule the character of the exudate was clear and coagulated with fixation (Fig. 10). The entire ventricular system may be thus dilated. No interference to the normal outflow of cerebro-spinal fluid could be discovered at the foramina of the fourth ventricle. An abscess developing within a confined space compressed the lateral ventricle directly beneath; if the brain was able to herniate from the skull, the ipsilateral ventricle was distended at that point. On the whole, the contralateral ventricle is more widely distended than the ipsilateral.

The bacterial invasion of the brain substance has shown marked variations in the rapidity of its spread, but an almost universal predilection to follow the fiber tracts rather than spread in the cortical gray matter. The result of such a mode of spread was the production of a pear-shaped lesion (in the early stages), the narrow neck of the abscess being located at the point of destruction of the cortex. At times this extended around neighboring sulci by picking out the fibers and from there it more slowly eroded its way through the cortex to the meninges. In some of the most virulent infections an abscess 2 cm. in diameter was found within twenty-four hours, being large and toxic enough to kill the animal. The core of the abscess quickly became granular and opaque. This necrotic center was surrounded by a more translucent gray zone while the latter, in turn, was hemmed in by a zone of punctate hemorrhages. The tendency toward ecchymosis was absent in very few instances, but often extended for a considerable distance beyond the actual necrotic process. By carefully picking (with a delicate instrument) the edges of the process it was impossible to demonstrate a wall of any tougher consistence than the normal nervous tissue itself; the edges everywhere were quite friable.

The central core was usually granular and somewhat inspissated, but in some instances it was represented by a clear gelatinous exudate (Fig. 12) which projected slightly from the plane of section. The walls of such a cavity were smooth. In one experiment there was present a gas-forming organism which produced a considerable gas filled cavity in the center of the abscess. As a rule, however, the abscess consisted of a necrotic core located for the most part in the white matter of the cerebrum and surrounded by a zone of small ecchymoses.

Marked change in color took place in the macroscopic appearance of the fiber tracts. It appeared first as a more translucent core developing within the center of the fiber tract near the abscess and radiating for some distance on the affected side. In the affected area, a thin fringe of white matter adjacent to the cortical gray preserved its pearly white appearance and served to set off the central part by contrast (Fig. 8). In most of the experiments this change was fairly well limited to the affected side, but occasionally it extended into the opposite hemisphere along the corpus callosum. Gradually this gray translucence spread to the outer limits of the fiber tract and the distinction between gray and white became almost obliterated (Fig. 12). It seemed to bear some relation to the pressure, inasmuch as it was less well developed in those cases in which a decompression had allowed the brain to expand.

There was a marked tendency for the arachnoid to be split away from the dura by a rapidly developing meningeal abscess. Even though a hole exists in the skull (Fig. 19), this collection of pus cannot evacuate itself because the expanding nervous tissue forms an efficient plug for the outlet. In twelve instances a considerable collection of subdural pus was present. A meningeal abscess of remarkable size followed an attempt at osteoplastic repair of the skull after the cortical abscess had been completely healed (Fig. 8). Such a meningeal abscess developed with remarkable rapidity and at times invaded the opposite hemisphere by extending down one side of the falx and back up the other. These abscesses have shown no tendency to invade the cortex, although they must exert a considerable pressure upon it.

MICROSCOPIC APPEARANCE OF BRAIN ABSCESSES

Under the low power of the microscope, the typical brain abscess in these experiments presented three well marked zones—a central core of necrosis, a surrounding fringe of leukocytes and a zone of vascular engorgement and hemorrhage. In the first two, all semblance to structural characteristics common to the tissue was obliterated, while the last, called by many writers “the necrobiotic zone,” still maintained characteristic appearances and staining reactions, and represented the transition between the dead and the normal living tissue. The destroyed center took the eosin stain very poorly and the hematoxylin not at all, except for patches of dense blue colonies of bacteria. The densely staining bacterial masses were found to be thickest in the periphery of the necrotic zone, just inside the cellular layer. Often within the necrotic zone surrounding a blood vessel, appeared small islands of tissue which had not been totally reduced to a homogeneous

appearance. The "burnt-out" character of the central core may be extensively developed within a few hours if the virulence of the organism is great. Where the process developed more slowly, the abscess had a laminated appearance (Fig. 14), as the cellular zone progressively died and was in turn encircled by a new layer of exudative cells. The width of the second or middle zone varied considerably. In a rapidly advancing process this layer was well developed and the cells infiltrated the tissues in enormous numbers. At such a time the outer limiting edge was comparatively smooth (Fig. 13). Apparently, the resistance of the tissue to invasion showed little local variation, and the process swept through the brain without the usual degenerative changes occurring in front of it. Beyond the leukocytic zone, as seen under the low magnification, there were changes referable especially to the vascular system. Red blood corpuscles had extravasated in quantities sufficient to obscure the texture of the nervous tissue. Serous infiltration may give it a loose watery appearance. Radiating from the abscess, the perivascular spaces were often packed with nucleated cells for a considerable distance (Fig. 3).

Low magnification demonstrated most clearly the relative resistance of the different regions of the cerebrum to infection. The fiber tracts were involved more rapidly and extensively than the gray matter. The cortical gray itself showed differences in the susceptibility toward destructive processes. Thus the molecular zone might survive, although for a considerable distance (Fig. 16), the ganglionic layers beneath and the meninges above showed complete destruction. Beyond the outer zone of hemorrhage and vascular change, the fiber tracts are usually much lighter in density of eosin stain than normal fibers. The initial stages of the translucent gray appearance, developing in the fiber tracts concomitantly with the increase in intracranial pressure, could be made out only under very low power of the microscope. This change was manifested by a slightly lighter stain with eosin when compared with the normal fiber bundles of the unaffected hemisphere. Under the high powers the differentiation between the affected and unaffected sides was impossible until the process had progressed for a considerable period. The subdural location of the meningeal abscess is well brought out in Figure 14. Owing to the shrinkage in embedding, an artificial separation has been produced between the abscess and the pia-arachnoid. The latter was heavily infiltrated with cells, but was distended very little more than normal.

A minute study of the central necrotic zone, during the early stages, revealed the shadows of exudative cells, faintly staining with eosin.

such an area appeared perfectly homogeneous, eosin-staining, and with no indication of any formed elements or bits of debris.

Surrounding the necrotic core was a zone of cells which was made up of a preponderance of polymorphonuclear leukocytes in the early stages. Very rarely the mononuclear infiltrating cells outnumbered them; then no accountable reason could be found. These small cells were the derivatives of the circulating blood and formed a closely packed boundary to the abscess. The outer limits of this zone was usually beyond the extension of demonstrable bacteria, sometimes, however, it was coincident with their growth, and very rarely the bacteria spread beyond their outer limits into tissue, recognizable structurally as nervous tissue. Sometimes, in localized areas, the bacteria grew beyond the infiltrated zone into the perivascular sheaths with no cellular reaction (Fig. 13). The more usual conditions are illustrated in Figures 7 and 15, where the leukocytes interpose themselves between the bacteria and the surrounding nervous tissue.

Enveloping the entire process was a shell of tissue in which the vascular changes were the predominant features. All the vessels were engorged with red blood cells, which in many places have escaped into the tissues. The ground-work was also infiltrated with a serous exudate, often coagulated and containing spicules of fibrin. There were many isolated leukocytes scattered in this area, but in general they were found in greatest numbers in the perivascular spaces (Robin) radiating from the edges of the abscess. Often the smaller vascular branches were so densely surrounded by these wandering cells that the lumen appeared compressed (Fig. 3). At some distance from the lesion they were confined absolutely to the perivascular spaces, but, as the edge of the leukocytic zone was approached, they invaded the tissue in increasingly greater numbers. The distention of the tissue elements by exudate was quickly followed by swelling up of the glia cells. These are normally inconspicuous with little protoplasm about the nucleus; in these cerebral infections after a few days they appeared more rounded and at times in the process of division by mitosis. The most striking phenomenon was the escape of erythrocytes from the vessels; this happened in varying degree in all of the experimental abscesses in this series. At times the ecchymosis was great enough to form an almost unbroken ring of free erythrocytes around the zone of exudative cells (Fig. 6) even extending for a considerable distance into what might be viewed as otherwise normal tissue. At other times they appeared as small punctate hemorrhages scattered around the periphery of the lesion. Such collections of red

blood cells usually formed a locus of increased resistance toward bacterial involvement. These islands of red cells indented the advancing edge of the process (Fig. 7) and only succumbed after being entirely surrounded by the infection. The ganglion cells in this outer zone showed the classic signs of degeneration—clumping of the Nissl bodies, chromatolysis, shrinking of the nucleus and disappearance of the cell. After several days this zone was invaded by young fibroblasts, most of which were derivatives of the pia-arachnoid and of the adventitia of the neighboring blood vessels. Elongated typical cells could be found developing from the meninges at the edges of the wound, and from this point they extended into the depths within the zone of necrobiosis. The adventitial sheath of the blood vessels in the neighborhood of the lesion also proliferated by mitosis and furnished fibroblasts which extended into the outer limits of the abscess. In none of the specimens was there the slightest evidence of an orderly arrangement such as might be looked on as a foundation for a capsule—nothing which could be interpreted as an early attempt on the part of the fibroblasts to interpose a barrier against the spread of the infection.

For the first two days in the development of the abscess, the infiltrating cells were composed almost entirely of leukocytes. After that the necrobiotic zone was invaded by increasing numbers of large mononuclears, known as "macrophages," which collect where the extravasation of blood is greatest and among the fiber tracts that were undergoing secondary degeneration. These cells were most conspicuous for their size, actively engulfing the products of tissue destruction until they reached enormous proportions. Such cells are so well known that an exact description of their appearance is superfluous. At times they were gathered in close formation occupying entire microscopic fields, their pale reticulated bodies and eccentric nuclei being in close apposition to one another. The activities of these cells in removing a blood clot are truly remarkable. This is well illustrated in Figure 16, a photograph of a brain section into which a button of bone was forced and a dense blood clot resulted. The lower central portion of the mass has been almost entirely removed by activity of these cells. Most of these are derived from the pia-arachnoid, adventitia of blood vessels, endothelium and neuroglia cells, where they could be seen to develop from the fixed tissue cells and to take on the characteristic lattice-work structure, typical of the protoplasm of the macrophage. When found among the degenerating fiber tracts their bodies were loaded with droplets that stained with osmic acid. At times they formed an almost

unbroken ring around the abscess just outside of the leukocytic zone. As the process spread they were included within the middle zone, but one gathered the impression that they were not associated with the active process in the same way that the exudative cells of the blood were concerned. Rarely these large phagocytes had entered the outer zone of the abscess in considerable numbers within forty-eight hours. Some of these animals had been previously used in other experiments and, in all probability, a considerable number of the macrophages were in the meninges at the time of the production of the abscess.

The traumatic brain abscess has been found to be occasionally accompanied by a considerable amount of transudate extending throughout the lesion. The zonular arrangement just described was then more or less obliterated. The pattern became a sort of mosaic of dead tissues, islands of exudative cells, homogeneous patches of eosin-staining material, and masses of red blood corpuscles. Throughout were crystals of fibrin embedded in a clear matrix, or woven among a loose collection of leukocytes. In these instances the actual number of organisms seemed to be very much reduced as compared with those in which a well formed necrotic center was produced.

The ganglionic layer and fiber tracts in the immediate neighborhood just beyond the outer zone of necrobiosis showed the well known signs of degeneration. The nerve cells whose fibers were involved swelled up and slowly degenerated. The neuroglia cells became much more prominent and showed mitotic figures. Their normally inconspicuous cell body increased in size, the appearance of the protoplasm became more watery and their processes, thick and rounded up. Their nuclei were often increased in number. The nerve fibers, undergoing secondary degeneration at a distance from the actual lesion, showed swelling of the axis cylinder, which broke up into granules of bizarre shape. These collected into a network with a more or less even mesh. Later they were invaded and removed by the large phagocytes. The most remarkable phenomenon about the spread of the abscess was the resistance to destruction shown by the molecular zone—quite frequently the ganglion cells beneath were destroyed completely for a considerable extent and it was possible to identify this thin strip of nervous tissue embedded in a mass of leukocytes and bacteria.

SPREAD OF INFECTION INTO MENINGES

The meninges in the neighborhood of the lesion were quickly infiltrated with leukocytes which formed a fair degree of protection against a rapid spread of the infection in the subarachnoid space.

Where a decompression allowed the brain to herniate, compression of this space apparently favored the effectual shutting out of a generalized spread, but this factor was never demonstrated. A common complication was the separation of dura and arachnoid by a rapid accumulation of pus and bacteria. The center of such an abscess soon showed signs of necrosis and grew by addition of leukocytes to the periphery. The degree of resistance toward spread into the subarachnoid space was very high, and it was a common occurrence to find countless bacteria growing on the outer surface of the arachnoid membrane without being able to demonstrate a single organism in the subarachnoid space beneath. At such times the latter cavity was filled with leukocytes and the perivascular spaces emptying into this area were crowded with white blood cells.

When the subarachnoid space became involved it usually was filled with a coagulated exudate. It often reached a considerable distention as shown in Figure 2. Bacteria, leukocytes, and macrophages were distributed through the meshes of the pia-arachnoid. After the abscess had existed for several days, large cells with metachromatic granules, eosinophils, and plasma cells appeared on the scene. At this time the molecular zone was constantly (less often the deeper zones of the cortex) infiltrated with leukocytes, and the neuroglia cells gave evidence of proliferation. The bacteria, however, were sharply limited to the subarachnoid space, and only exceptionally began to break down the resistance of the pia mater and the molecular zone of the cortex, and to spread within the substance of the brain. It is interesting to note that only infrequently did the organisms grow into the perivascular spaces and invade the nervous tissue in this way. To repeat, the distribution of bacteria was confined by natural boundaries in the two limits of the subarachnoid space, that is, the pia mater and the arachnoid membrane. Infections spread through these thin connective tissue membranes only with great difficulty.

There was evident no natural barrier protecting the ventricles from invasion. As the growing abscess neared the ventricular wall, the ependymal lining of the latter was raised up by an exudate of serum and leukocytes. The character of the ventricular fluid was then so modified that it could be stained in section by eosin and toluidin blue. The fluid in the ventricle, which coagulated following fixation, showed no fibrin deposition. It contained a very few cells, mainly leukocytes of the mononuclear variety. The number of intraventricular cells increased with the steady progress of the bacteria toward the ventricle while the proportion of the polymorphonuclear leukocytes became

augmented. The effort of the exudative cells to localize the process to the invaded portion of the ventricle was usually partly successful, and for a time only the ipsilateral ventricle contained a cellular exudate, but the rest of the ventricle was slightly dilated with a homogeneously stained fluid. As a rule, however, the infection spread throughout the ventricular system when once the bacteria gained access; the whole system became filled with organisms and pus cells. The spread through the foramina of Luschka and Magendie resulted in a basilar meningitis which extended rapidly down the cord and into the adjacent cisterns. During this invasion of the ventricle, the choroid plexus maintained a fairly normal appearance, although large areas of the parietal ependyma and subependymal tissue became excoriated. A few polymorphonuclear leukocytes infiltrated the connective tissue stroma of the choroid and the vascular plexus was slightly dilated; but in spite of the fact that the ependyma covering the choroid plexus was bathed in pus and bacteria, but little degeneration occurred. After a time the stroma became filled with a massive cellular exudate so that the plexus was greatly thickened. A few bacteria were found within the epithelial covering and the latter began to swell up and separate from the stroma. Shreds of detached epithelium could then be seen undergoing degeneration in the debris filling the ventricle. More often the death of the animal ensued before total destruction of the choroid plexus took place. Where the original wound communicated with the ventricle the entire ventricular system became quickly dilated with a compact cellular exudate and the sero-fibrinous character of the exudate was much less marked.

REPAIR

There were no experiments in this series which might be regarded as intermediate steps leading to the elimination of the process. Thirteen of the thirty-five animals died within forty-eight hours; sixteen died within a week but lived more than forty-eight hours, and three died nine days after the injury. There were only three that survived; these animals were killed at the end of two, three and four months, respectively. In the first instance, the cerebral lesion was irrigated with chloramin solution on several occasions, and the gross picture was that of a solid replacement of the destroyed nervous tissue by connective tissue without the usual formation of small cysts. In this specimen there were streaks of brilliant salmon pink radiating from the meninges down into the substance of the brain. The brains of the other two animals which survived showed cysts of various sizes on cross-section.

The original volume of the brain was much diminished where the wound occurred and the lateral ventricle showed a dilatation at this point (Fig. 4). In all three of these specimens the leukocytes had disappeared from the scene entirely. Strong bands of fibrous tissue arising from the fused dura and pia-arachnoid radiated into the area of destruction, carrying with them vessels from the meningeal system. Between this connective tissue replacement and the normal nervous tissue was a zone of gliosis. The phagocytic cells were still present in considerable numbers, being heavily laden with pigment. No glial cells could be found within the scar-tissue itself. The cysts were outlined by connective tissue and were often filled with macrophages. Often these cavities were in direct communication with the perivascular space. In one of the animals, the scar tissue replacement showed that the lateral ventricle had been penetrated, but the break in continuity of the ventricular boundary had been subsequently sealed over completely. None of the cystic dilatations around the perivascular spaces communicated with the ventricles. The ependymal lining at the end of four months had not yet begun to cover up the defect caused at the time of injury. The pattern of the subarachnoid tissue spaces was carried into the defect from the outside (Fig. 4), and resulted in a considerable widening out of the subarachnoid space at this point. None of these cystic enlargements seemed to communicate with the subarachnoid space. Every one of the animals which survived the infection showed a healed process in every way comparable to the healing of a sterile ablation of a similar amount of brain tissue. In none of them was found a walled-off process similar to the chronic abscesses encountered in extensions from the middle-ear or the solitary encapsulated abscesses in human beings.

DISCUSSION

The problems confronting us in acute traumatic abscesses of the brain are primarily two: (1) the factors influencing the development of a destructive bacterial invasion of the brain, and (2) a repair of the lesion. The first comes under the head of inflammation, while the latter has to do with the re-establishment of a viable organism. Concerning the repair of brain lesions, considerable experimental work has been carried on, and the histology of the events leading to the establishment of a physiologic equilibrium is fairly well understood. A complete restoration of destroyed nervous tissue is never attained, and even in new-born animals the nervous system is too completely differentiated to reproduce any new elements. Function can be par-

tially taken over by other cells, and when confined to certain areas of the cerebral cortex a normal individual, to all intents and purposes, may be preserved. The final repair is almost exclusively a partial replacement by connective tissue accompanied by a new ingrowth of vessels and to a very slight extent by the neuroglia which interposes a zone of sclerosis between the fibrous scar and the normal nervous tissue. An understanding of the factors involved in the destruction of the nervous elements, along with the efforts to halt its spread and the removal of the debris, namely, inflammation, will give us a clue to a rational therapy.

Experimentation which would show only the processes concerned in inflammation to the exclusion of those concerned in repair is manifestly impossible. Every experiment in inflammation must, of necessity, include a varying mixture of both these phenomena in the same specimen. On the one hand must be considered the bacterial agent elaborating toxins which diffuse into the tissues; the effect is not limited to the area directly reached by the poison but extends for a great distance by secondary degeneration of the affected neurons. On the other hand, there are the countless defensive cells poured out from the vessels in an effort to halt the spread of the destructive agents; the removal of dead material by the cells of the macrophage class; and finally, the reparative efforts of the young fibroblasts. All of these processes are intermingled and exist in varying proportions in different localities of the wound. In addition to these generalizations, there must be taken into account the factors peculiar to the central nervous system — absence of fascial planes, the effect of the chemical constituents of the degenerating tissue, the ease with which the brain can distend, and the effect of the rigid envelop which permits of little expansion — in a word, the anatomico-physical characteristics of the affected organ.

The division of the pathologic process into three zones serves a useful purpose in presenting the microscopic description in a more or less orderly way. As an active process, another kind of division would perhaps furnish us with a more logical conception of a traumatic brain abscess. This would consider but two zones: (1) a central necrotic foreign body, the source of soluble toxins, and (2) a peripheral zone in which the struggle between two opposing forces takes place. In this latter zone, which is a combination of the zone of cellular exudate and necrobiotic zone, the course of the abscess is determined: the termination may be either (1) a losing fight in which the animal as an organism succumbs, or (2) a retardation of the spread until a connec-

tive tissue capsule may be formed, or (3) an actual neutralization and elimination of the bacterial agent. In these infections where the streptococcus was present, the central core became in every sense a foreign body. Encircling this the organisms grew luxuriantly and formed the reserve depot from which a spread forward could be made in case the tissues were sufficiently weakened. The outer zone represents the vascular changes and associated exudation met with in inflammation. The diffusion extends from the central mass into the periphery, with a progressively weaker effect as it diffuses from the point of elaboration. The structural tissue is killed or damaged and the blood vessels become unable to hold within their walls the fluid and nonameboid elements. This zone of exudate and hemorrhage becomes the arena in which the fate of the animal is determined. If the virulence of the organism is lower than the combined resistance of cellular exudation and development of antitoxic bodies, then the so-called zone of "red softening" turns progressively to one of a salmon yellow, and finally, to one of brown color. If the relative strengths of the infection and resistance are reversed, the bacteria grow forward into the outer zone which is progressively incorporated into the necrotic center. In some types of infection the tendency of the red cells to spill out into the tissues is not marked. Just how this factor modifies the spread of the infection will be discussed later. The ecchymosis of red corpuscles is in all probability a weak chemical protection and ought not to be considered as a part of a preparation for the formation of a purulent inflammation. The notion that an abscess is always preceded by "red softening" gives a false impression in that it makes the effect appear to be the cause. In no wise does it help our conception of the processes going on in the development of a purulent focus. The evidence points away from the idea that red softening is in any way a "preparation" of the nervous tissue for the development of an abscess.

The kind of infection used in these experiments may be considered under two heads: (1) pure cultures, and (2) pus. The former always proved to be the weaker in virulence, while the latter probably owed its destructiveness to the associated aggressins. By passing the pus from the cortex of one animal to another, a rapidly fatal lesion could be produced, with death within twenty-four hours. In these instances the effectiveness of the toxin was shown in the widespread "burnt-out" appearance of the tissue as well as the uninterrupted advance of the organisms. Their distribution was more or less uniform throughout the abscess and extended for a short distance beyond the cellular

exudate into the zone of necrobiosis. When the virulence was not so great, the bacterial invasion was sharply confined to the central zone of necrosis. The failure to spread invariably into a purulent meningitis from the point of injury is interesting. Rarely does the subarachnoid space contain organisms at any considerable distance beyond the lesion. On the other hand, the subarachnoid space or brain tissue may not be involved even when the subdural accumulation of pus reaches enormous proportions. The occurrence of a leptomeningitis follows much more often a spread from the ventricles through the foramina in the hind-brain. This spread into, or direct inoculation of, the ventricle is one of the most serious complications of a brain abscess.

The natural resistance to the spread of infection is very inadequate. The only barriers at all comparable to the fascial planes elsewhere, are the meninges. The essential elements taking part in this protection are the cells making up the pia-arachnoid. Their behavior toward debris introduced into the subarachnoid space has demonstrated the active rôle played by these mesothelial cells. Under the stimulus of products of tissue destruction, they proliferate and give rise to ameboid mononuclear cells with marked phagocytic powers (Essick¹⁴). Figure 17 shows them massed at the glued edges of the meninges bordering a brain abscess. By removing the destroyed tissues they help to keep the meningeal spaces open so that a circulation of cerebro-spinal fluid is possible. The abscesses following extension from the air sinuses (middle ear, frontal, etc.), meet with a definite obstruction in the dura, but the more cellular leptomeninges are extremely resistant to a spread at right angles to their plane. The delicate arrangement of the closely interweaving fibrils in the pia mater and the arachnoid membranes keeps the process on either side of them very sharply localized. Thus an encephalitis is halted at the pia and prevented from becoming an uninterrupted meningitis; a subdural abscess is similarly checked by the arachnoid membrane. The massive growth of bacteria beneath the dura may not only cover a large part of one hemisphere, but also extend beyond the mid-line beneath the falx-cerebri, and yet if one searches carefully it may be impossible to find a single organism within the cellular exudate in the subarachnoid space, whereas the outer sur-

14. Essick, C. R.: Formation of Macrophages by the Cells Lining the Subarachnoid Cavity in Response to the Stimulation of Particulate Matter, Carnegie Institution of Washington, Publication 272, 1919. Contributions to Embryology, 9.

face of the arachnoid membrane is literally covered with them. To be sure, this resistance may be broken down, but only after the tissues have been grossly insulted. The normal amount of connective tissue within the substance of the brain is almost negligible, being confined to the thin sheaths of the vessels.

The rich, close-meshed capillary plexus within the gray matter may be one factor in determining the relatively greater resistance of the gray matter to infection as compared with the white matter. The latter is provided with a system of elongated capillary loops so that the blood supply is very much poorer than in the cellular layers. This disparity in resistance of gray and white matter is further heightened by the fact that the central end of an injured neuron may live, but the peripheral end always dies. The nuclei of the cells making up the fiber tracts are situated largely in the cortical gray and the secondary degeneration in the peripheral end of the nerve fiber furnishes a good culture medium for the bacteria.

The most efficient protection for the substance of the brain is that supplied by the leukocytes which pour out into the perivascular spaces around the injury and quickly form a cellular barrier against the spread of the infection. Probably the injury to the tissues is the primary stimulus in the case of the ordinary infection, but shortly after an absorption of the toxic substances makes increased demands on the white blood elements. Long before any antibodies may be formed, the bacteria have created quite an area of necrosis at the point of injury. The blood vessels become dilated and enormous numbers of leukocytes crowd the perivascular spaces. White blood cells emigrate from all the small vessels in the neighborhood and crawl toward the lesion, preferably along the perivascular spaces. If the infection be entirely meningeal, the perivasculars are transformed into veritable crowded highways by the white cells hurrying toward the subarachnoid space. Such "perivascular exudate" should not be viewed as an invariable sign of encephalitis, but rather as the natural pathway for inwandering cells. These perivascular spaces would make excellent natural channels for the spread of organisms through the nervous tissues were it not for the fact that the advance of the bacteria is very early blocked by the cells coming into these perivascular channels from the blood-stream. Occasionally one comes on a vessel that has become thrombosed, and then it furnishes an excellent pathway for the spread of the bacteria. Inasmuch as the leukocytes in such a case do not continue to come out of the vessels into the perivascular spaces, the latter become literally filled with colonies of bacteria (Fig. 9). The leuko-

cytes, then, both of the polymorphonuclear and the small mononuclear variety, are the best protection that the brain may acquire quickly. The predominating type of cell cannot be predicted, and the variety of the cell seems to be entirely independent of factors under control.

There is unquestionably some development of antibodies in the blood stream, but in this type of abscess, protection from such a source must be a small factor in overcoming the process. A far better chemical protection is to be found in the escaping whole blood which occurs in the necrobiotic zone in considerable quantities. The efficacy of this mechanism has been demonstrated in several ways in this series of experiments. In one animal in which a button of bone was pushed into the wound it was seen at necropsy that a very large hemorrhage had developed (Fig. 16). Microscopically, this portion of the injury proved to be absolutely unaffected by the infectious process, although this had involved a considerable amount of the cerebral hemisphere. Not only does such an area of hemorrhage remain uninvaded by the organisms in the midst of so much infection, but also the extravasated corpuscles are actually being removed by the phagocytes while young fibroblasts and blood vessels sprouts are beginning to repair the defect. Another remarkable instance of the protective powers of blood is shown in Experiment 66. Owing to the scarcity of animals when experimental abscesses were made, a good many of the cats had to be used for more than one observation. After each experimental procedure they were allowed to live for several weeks and to regain their "normal" appearance. After serving as the subject of three experiments on the central nervous system and recovering, this cat, while under ether, was struck on the head with a sharpened nail and the wound infected. Gross necropsy showed that the puncture had been made so close to the mid-line that a large meningeal vessel had been opened up and a hemorrhage had covered the left cerebral cortex for at least 2 cm. from the brain wound. There was no evidence anywhere of a meningitis macroscopically. The animal had lived for three days, and when studied microscopically showed an extensive destruction of brain tissue. The bacteria were growing in enormous numbers along the natural pathways in the nervous tissue. There was no cellular zone visible under low magnification, and with higher powers, a few inwandering polymorphonuclear leukocytes were observed as single cells, scattered around the edges of the abscess. Apparently, the previous experimentation had in some way broken

down the responsive cellular exudate and the bacteria proliferated within the brain much as if they had been planted on cultural media. In this instance the lesion was absolutely localized to the substance of the brain, and not a single organism could be found growing within the subarachnoid space. The whole blood formed a perfect barrier against a spread of organisms in the meningeal spaces and constituted the sole protection against a meningitis.

Most of the experimental abscesses were marked by a varying tendency to ecchymosis. The actual number of red blood corpuscles was usually not great. Such small accumulations of erythrocytes offer a momentary obstruction to an uninterrupted advance of the infection. The more susceptible areas allow the infection to work around the sides of the blood extravasation. Thus in Figure 7 the perivascular hemorrhage stands out as a salient, retarding the line of advancing bacteria. Finally, such accumulations of red corpuscles are completely surrounded and gradually are included in the necrotic core. This may help us to understand the value of the treatment of penetrating wounds of the brain at the battle front. The best results have followed extensive lavage of the tract and tight closure of the wound. The chemical value of hemorrhage seems to lie in the red blood corpuscle rather than in the serous or the fibrinous exudate.

Of certain value is the relief of pressure developing in a confined space. Increase of brain bulk is unquestionably the beginning of a vicious circle and is the worst complication which follows a traumatic infection. The method of combating the rising pressure within the brain by opening the skull and dura has been employed by surgeons for a long time. Certainly, it prevents the dislocations if enough outlet is given to the expanding brain, as is seen in Figure 19. The most distressing feature follows the trephining of the skull and the formation of a sloughing and infected fungus. It is to be hoped that the reduction of brain-bulk following the alteration of the tonicity of the blood will give a practical method of removing the cause, instead of trying to combat the effect. A very suggestive method of modifying the development of edema and its correlated increase in intracranial pressure may be found in the work of Weed and McKibben.¹⁵ It may be that the effects of trauma can be overcome by suitable intravenous injections of hypertonic solutions of salt or dextrose, and the phe-

15. Weed and McKibben: Experimental Alteration of Brain Bulk, *Am. J. Physiol.* 48:531 (May) 1919.

nomena of swelling be temporarily, at least, if not permanently obviated.

The factor of injury in traumatic abscess of the brain is most important from two standpoints. The most obvious is the destruction of brain-continuity and its associated secondary degeneration. Less obvious, but more important, is the swelling of the injured portion of the brain following such injuries. The most careful manipulation of the normal brain is sufficient to set in motion the factors increasing the size of the organ. These causes are little understood, except for the general concept of disturbance of balance of the tissue fluids, the intercellular, cerebrospinal and intracellular fluid. Edema of the brain, when the skull and dura are unopened, causes a rise in pressure of the contents of the cranium and must facilitate the thrombosis of vessels in the injured area. The actual blood supply is seriously interfered with at a time when there should be a protective hyperemia. The resultant dislocation of so delicate a mechanism caused by the swelling of one region and a compression of the rest is a most serious complication. Added to this phenomenon is a ventricular dilatation which further reduces the available space for normal tissue. Such a complex results in an increased susceptibility to destruction where a bacterial agent is present, and serves to prolong the edematous condition initiated with the original wound. The relief of such a condition by trephine merely transforms one complication into another which is little less of an evil. The infected hernia seems to have no end to the possibility of expansion. It cannot be too strongly emphasized that this phenomenon of injury, and its associated swelling, is the essential difference between traumatic brain abscesses which run such an acutely destructive course and the slow-growing abscesses which extend from the air passages. Operative procedures aimed at the cure of the slowly growing abscesses must scrupulously avoid all unnecessary disturbance of the healthy brain tissue, lest they excite the phenomena of brain swelling and transform the chronic abscess into an acute traumatic one.

The products of secondary degeneration of the fiber tracts offer an excellent medium for the culture of bacteria. The presence of the fatty derivatives of myelin must have a decided influence on the growth of the organisms as well as retard the interchange of fluids between the necrotic center and the surrounding tissues. These experiments with foreign bodies were too few to draw any conclusions as to their

effect on the progress of an abscess. Infection of the ventricle seems to bear no relation to the general reaction of the animal, whether inoculated directly or becoming involved by a secondary spread. In the thirty-five experiments recorded here, the length of life seemed to be governed by the virulence of the infection. One of the cats surviving the infection showed that the original wound had penetrated the ventricles and reached the surface of the cortex on the side of the brain farthest away from the entrance of the perforator.

As far as can be determined the nervous tissue has practically no natural planes in which infection may spread with greater difficulty. The neuroglia forms a feltwork which makes the gray and white matter practically homogeneous. Secondary degenerations furnish a decrease in resistance, but this cannot be looked on as preformed. The perivascular spaces are natural channels which can be invaded by bacteria. Unless the normal protective mechanism is disturbed, either by interfering with the response of the white blood cells, or by thrombosis, such channels cannot be entered by the bacteria. The spread of an infection occurs by direct destruction of the tissue assisted by the secondary degenerative processes formed by nerve fibers separated from their cells of origin.

Mingled with the processes of destruction and protection are cells whose main function is to remove the debris. The large phagocytic cells appearing in such enormous numbers in the central nervous system were regarded by the early writers as pathognomonic of inflammation. In no inflammatory process elsewhere in the body do they appear in like numbers. The formation of such large phagocytic elements from the cells of the arachnoid, from those of the vascular adventitia and from neuroglia cells has been demonstrated to occur under the influence of altered environment. These transformed cells gather in the region just beyond the zone of leukocytes as long as the infection is active, greedily ingesting the free red cells, dead leukocytes, and products of destruction of the nervous tissue. If the organisms are killed and their toxins neutralized, these macrophages invade the necrotic core and remove it. Long after the last leukocyte has left the scene these large cells are found in great numbers, with their bodies distended with ingested material. The removal of the debris is exceedingly slow in the brain, since it depends entirely on the ameboid activity of these large mononuclears. The lack of a lymphatic system, which, in the infections of the tissues of the body generally, plays an important rôle in the removal of waste products of inflamma-

tion, may easily account for the increased demand for these cells in processes involving destruction of the nervous system. Where the abscess spreads rapidly, these phagocytes appearing beyond the leukocytic wall are destroyed, and as a result, few are demonstrable in this type of lesion. Where the extension is slow, or where the rate varies considerably in different localities of the same abscess, these cells are often found in such numbers that they almost replace the normal structures.

The attempt to repair the lesion is instituted within the first few days. Such repair is entirely brought about by the fibroblasts and new vascular sprouts. They are the derivatives of the meningeal mesothelium and of the adventitial cells of the blood vessels. In the slowly growing abscess these efforts are partially successful and a capsule is formed and serves to retard the spread of the process to a marked degree. This mechanism is too slow to be of any assistance in stopping a traumatic abscess. These fibrous elements form, however, the tissue which replaces the lost structures, if the infection is overcome. This fibrosis of the defect is, however, frequently complicated by the formation of cysts in the scar. These develop as dilatations of the perivascular spaces and are to be explained as accumulations of intramedullary cerebrospinal fluid, the free drainage of which has been interfered with (Pick¹⁶). The superficial defect of the brain is partially filled by an increased development of the subarachnoid tissue, the meshes of which are in free communication with the rest of the cerebrospinal fluid spaces.

SUMMARY

Experimental abscesses produced in the cortex of thirty-five cats by injury and infection of the brain, resulted in a rapidly fatal process which simulated the traumatic injuries of the central nervous system in man. The affected part enlarged and brought about a marked dislocation and compression of the rest of the nervous tissues. In 50 per cent. of the cases the infection reached the ventricular system within a few days, and from there usually spread into a basilar meningitis through the metapores of the fourth ventricle. The tendency of the infective process to invade the subarachnoid space from the point of injury was not marked, but in a third of the animals the infection entered the subdural space, forming there a subdural abscess.

16. Pick, A.: Ueber cystöse Degeneration des Gehirns, *Arch. f. Psychiat. u. Nerven.* **21**:910, 1890.

These lesions were very different from the more slowly growing abscesses extending from the air sinuses. The latter, occurring frequently in man, may be differentiated by the relatively slight swelling and dislocation, and by the development of a definite connective tissue capsule between the lesion and the sound parenchyma. The traumatic abscess in the experimental animal extended rapidly along the fiber-tracts. No encapsulation could be demonstrated in any of these observations. Healing took place by the ingrowth of connective tissue.

Plate 1—Explanation of Figures.

Fig. 1.—Photomicrograph. Abscess of three days' duration, confined almost exclusively to the fiber tracts. The center was occupied by a large bubble of gas. An extensive subdural abscess is complicating the brain lesion. (Hem.-eosin, $\times 37$.)

Fig. 2.—Photomicrograph through the leptomeninges immediately adjacent to the abscess. An early stage of meningitis accompanied by an extensive serofibrinous exudate. The perivascular spaces of vessels penetrating the cortex are crowded with leukocytes. (Hem.-eosin, $\times 72$.)

Fig. 3.—Photomicrograph of the brain tissue just beyond the leukocytic zone (top of figure). The perivascular spaces are engorged with leukocytes, practically obliterating the lumen of the vessels. (Hem.-eosin, $\times 77$.)

Fig. 4.—Photomicrograph—healed abscess. Dura adherent to defect in cortex. Small cysts are located in the connective-tissue replacement. Lateral ventricle dilated under the injury. (Hem.-eosin, $\times 3$.)

Fig. 5.—Retouched photograph of head of cat in which cerebral hemispheres are partially exposed; the dura is intact. The injury appears in the dark area of the left hemisphere. The brain markings are obliterated on the affected side by a thick purulent subdural exudate. This is sharply limited, medially, by the falx cerebri. The right hemisphere shows engorgement of blood vessels with a very slight loss of distinctness of brain markings. ($\times 1$.)

Fig. 6.—Photomicrograph. Left side of picture—zone of leukocytes. Middle shows a layer of extravasated erythrocytes interposed between the lesion and the normal tissue (on the right). (Hem.-eosin, $\times 60$.)

PLATE 1

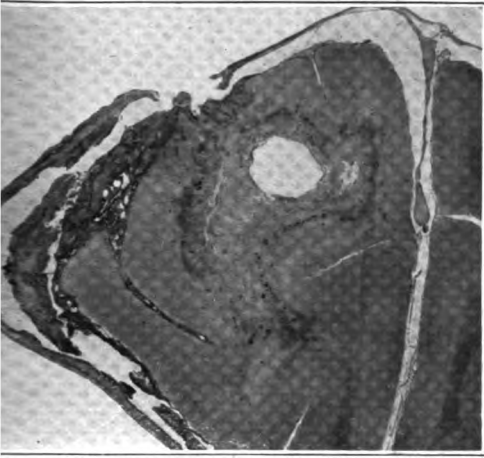


Fig. 1.

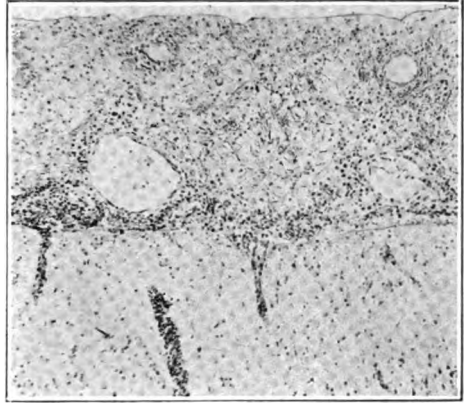


Fig. 2.



Fig. 3.

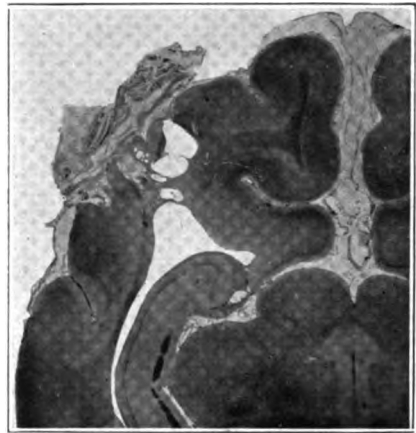


Fig. 4.



Fig. 5.

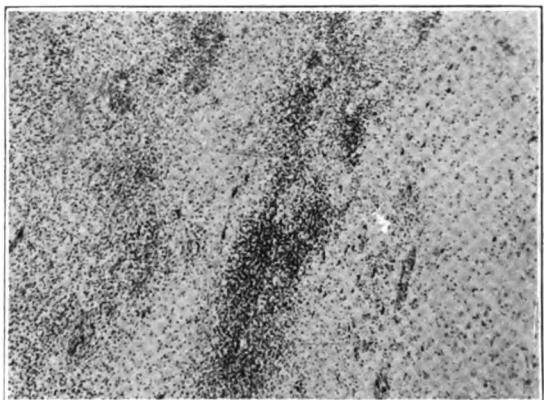


Fig. 6.

Plate 2—Explanation of Figures

Fig. 7.—Photomicrograph. The center of the figure shows **two vessels**, the perivascular spaces of which are filled with red blood corpuscles. The infection is momentarily halted at this point but the organisms are **out-flanking** them on both sides; separated from the normal tissue (right side of figure), however, by a wall of leukocytes. (Hem.-eosin, $\times 60$.)

Fig. 8.—Compression and dislocation of brain by a large subdural abscess. The left lateral ventricle is slightly compressed and the right correspondingly enlarged. The white fiber tracts on the left side show the early development of a translucent gray core. (Drawing $\times 1.4$.)

Fig. 9.—Photomicrograph of abscess showing the rapid extension of the bacteria when unimpeded. All the darker masses represent conglomerate colonies of organisms—completely filling the perivascular spaces. (Hem.-eosin, $\times 60$.)

Fig. 10.—Photograph of sections through a brain in which a rapidly developing abscess of two days' duration has spread into the ventricle. The left lateral ventricle is distended with inspissated pus while the right is dilated with a clear coagulum. This shows a remarkable dislocation of the left hemisphere and a compression of the right. ($\times 1.2$.)

PLATE 2

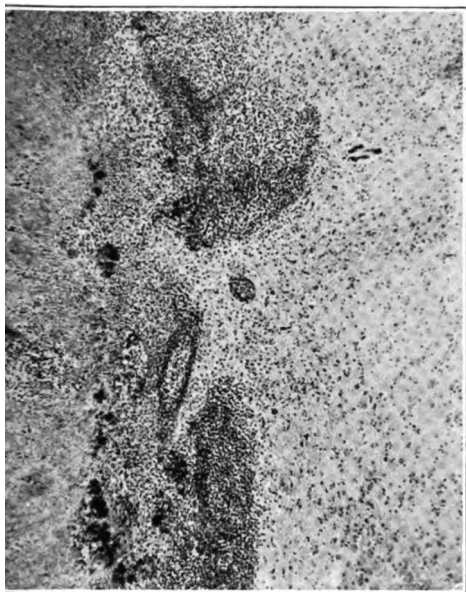


Fig. 7.

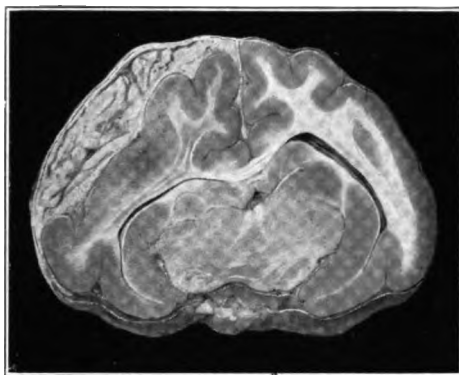


Fig. 8.

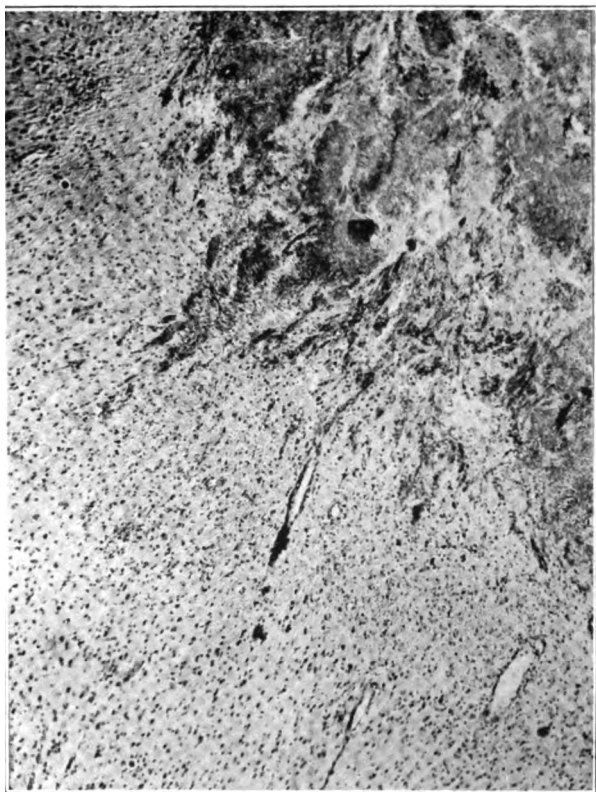


Fig. 9.

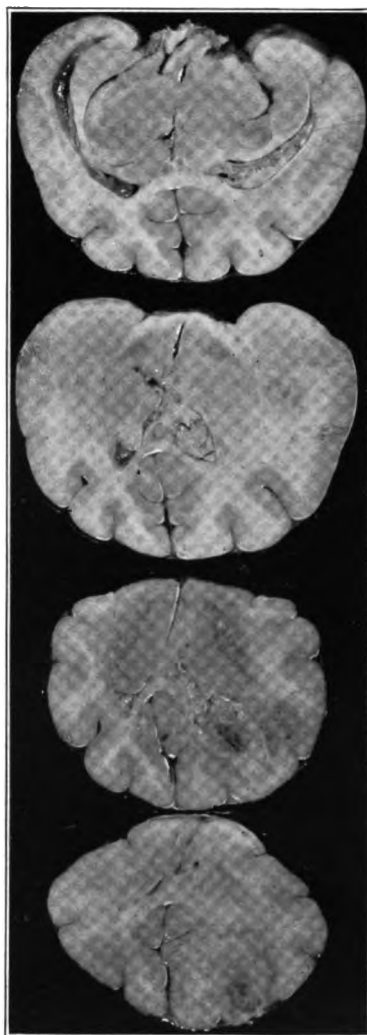


Fig. 10.

Plate 3—Explanation of Figures

Fig. 11.—Photograph. Sections through cat's brain showing the invasion of the fiber tracts by an abscess. This lesion is accompanied by a blood-tinged exudate and photographs black. ($\times 12$.)

Fig. 12.—Cyst forming within an abscess. The entire white matter is translucent on the affected side so that the distinction between cortex and fibers is almost obliterated. (Drawing $\times 12$.)

Fig. 13.—Photomicrograph. The spread is extremely rapid as shown by the thickness of the zone of leukocytes. In this specimen bacteria actually are found beyond the sharply delimited wall of leukocytes. Death of animal occurred in three days. (Hem.-eosin, $\times 60$.)

Fig. 14.—Photomicrograph showing the lamination of a slowly developing abscess and the predilection for the white fiber tracts. The three indentations in the periphery of this process are the seat of perivascular hemorrhages. The large subdural abscess has separated from the leptomeninges. ($\times 32$.)

Fig. 15.—Photomicrograph showing the grouping area of organisms and their mode of breaking through the leukocytic defense. The upper part of figure is the necrotic core. Extending in two broad columns are the two waves of bacteria; the one on the left is separated from the necrobiotic zone (bottom of figure) by a very few leukocytes. (Hem.-eosin, $\times 60$.)

PLATE 3

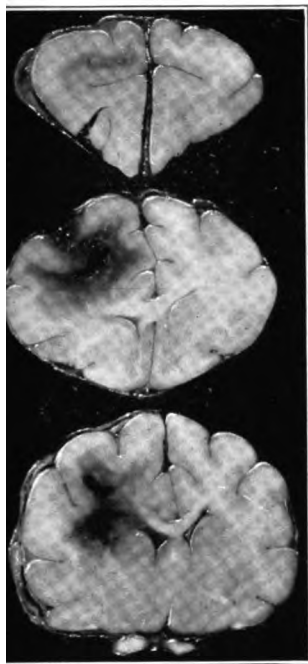


Fig. 11.



Fig. 13.

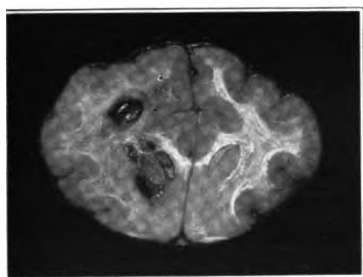


Fig. 12.

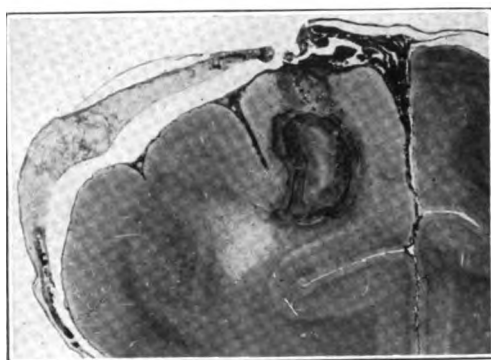


Fig. 14.



Fig. 15.

Plate 4—Explanation of Figures

Fig. 16.—Photomicrograph of a transverse section through entire cortex of cat. The abscess has developed within the white fiber tracts and into the thalamus. An extensive hemorrhage at the base made an efficient barrier to the spread in this direction. A large part of the blood has already been removed. This process lasted nine days. ($\times 3.3$.)

Fig. 17.—Photomicrograph of a wall of macrophages derived from the pia-arachnoid which is shown blocking the subarachnoid space and preventing the destructive infection (upper part of figure) from spreading into a meningitis. (Hem.-eosin, $\times 60$.)

Fig. 18.—Photograph of section of cat's brain in which the original wound communicated with the ventricular system. The lateral ventricles are dilated with pus. ($\times 1.4$.)

Fig. 19.—Section through abscess developing under a trephine hole made in the skull. Remarkable hernia of left side of brain. The displacement is very great on account of a rapidly developing subdural abscess. Right hemisphere not compressed, as shown by midline. Six days' duration. ($\times 1.3$.)

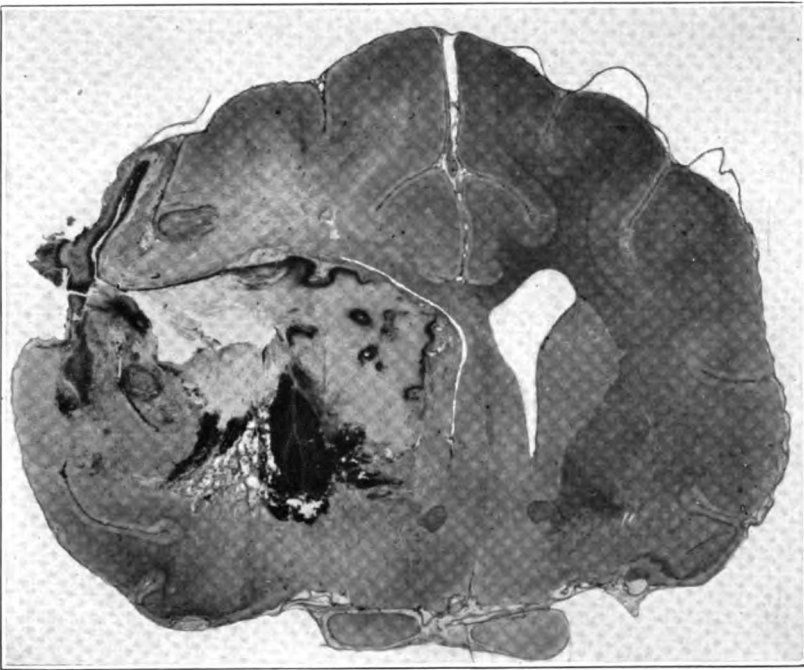


Fig. 16.

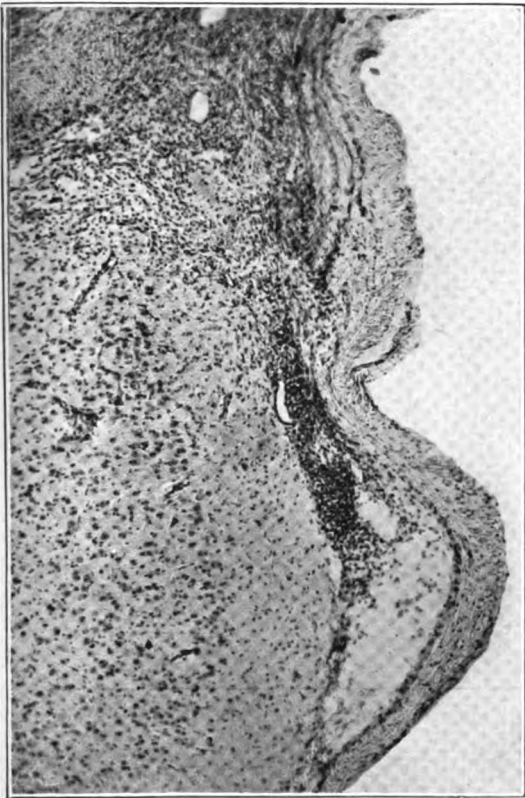


Fig. 17.

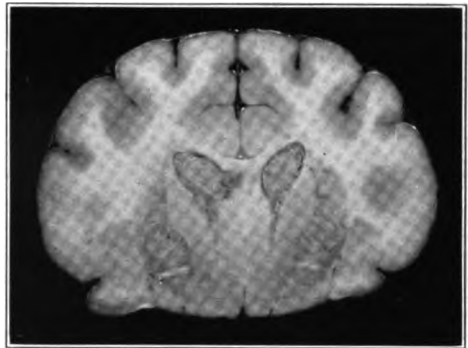


Fig. 18.

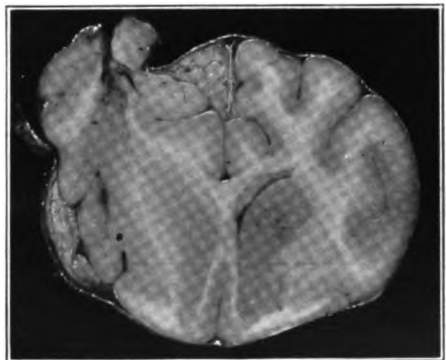


Fig. 19.

HISTOPATHOLOGY OF CARCINOMA OF THE CEREBRAL MENINGES *

G. B. HASSIN, M.D.

Attending Neurologist, Cook County Hospital

CHICAGO

It is generally admitted that carcinoma of the nervous system is always a secondary process, spreading either from neighboring affected regions, or reaching the brain and its meninges by way of metastases. There have been recorded a few cases of so-called primary carcinoma of the brain (Gedge-Latham,¹ Rustizky,² Russel,³ and Coats⁴), but these cases proved to be, on closer examination, some other varieties of tumors, like glioma, endothelioma or sarcoma.

The statistics by Buchholz,⁵ Gallawardin and Varay,⁶ Kaufman,⁷ Krasting,⁸ Fischer and De Foy⁹ not only demonstrate the relative frequency of metastatic growth of cancer in the brain, but also that it may originate from any organ in the body, no matter how remote. Thus, it may come even from the prostate, rectum or ovaries, and make its first appearance long after the original growth has been removed. In Guttman's¹⁰ case the brain showed metastases eighteen years after an operation for ovarian carcinoma, and in Gallawardin's case,⁶ eight years after the primary tumor was located (in the sub-clavicular space). In this case about 200 nodules were found in the substance of the brain and spinal cord. In the majority of recorded cases distinct gross or microscopic nodules were found which could very well account for the various clinical symptoms, as hemiplegia, monoplegia, aphasia, jacksonian epilepsy, single or combined nerve paralyzes, various psychical disorders, etc. But cases have been reported in which no metastases in the brain tissue could be demon-

* From the Laboratory of Pathology, Cook County Hospital.

1. Gedge-Latham: Primary Carcinoma of Brain, Brit. M. J. **1**:284 (March 27) 1869.

2. Rustizky: Virchows Arch. f. path. Anat. **59**:191, 1874.

3. Russel, J.: Brit. M. J. **2**:709 (Dec. 2) 1876.

4. Coats, J.: Primary Carcinoma of Brain, Brit. M. J. **1**:959 (May 4) 1888.

5. Buchholz: Monatsch. f. Psychiat. u. Neurol. **4**:183, 1898.

6. Gallawardin and Varay: Rev. de méd. **23**:441, 1903.

7. Kaufman, E.: Cor.-Bl. f. Schweiz. Aerzte **36**: 1906.

8. Krasting, Karl: Same as Footnote 7. Published in extenso in Ztschr. f. Krebsforsch. **4**:315, 1906.

9. Fischer and De Foy: Ztschr. f. Krebsforsch., 1905, p. 195.

10. Guttman, C.: Fortschr. d. Med., 1904, No. 4, p. 141.

strated, in spite of the presence of marked clinical symptoms of brain lesion. Such cases have been explained by Oppenheim¹¹ as toxemic, that is, caused by the cancer toxins, just as uremia or diabetes may produce clinical symptoms of brain lesion without any demonstrable anatomic changes.

Oppenheim's view was also shared by Nonne¹² and Siefert.¹³ However, cases of supposed cancerous toxemia became practically unknown after thorough microscopic studies were made not only of the brain substance, but also of the meninges. It was found that the brain tissue itself may be totally free from cancer elements, while the dura or pia-arachnoid is so infiltrated as to cause serious symptoms such as hemiplegia, aphasia, etc. The infiltration may be of the dura only, causing it to appear thickened and hemorrhagic, resembling so-called hemorrhagic internal pachymeningitis. In fact, such cases have been described as "pachymeningitis carcinomatosa" (Westenhöfer,¹⁴ Dahmen,¹⁵ Lissauer¹⁶). In other cases there was no real involvement of the dura, but rather of the pia-arachnoid. The latter group of cases have been described as "meningitis carcinomatosa" (Siefert,¹³ Saxer,¹⁷ Scholz,¹⁸ Stadelman,¹⁹ Krause,²⁰ Schwarz and Bartels²¹). These two terms, pachymeningitis and meningitis, imply an inflammation of the corresponding cerebral membranes, and some authors^{14-b} claim that there is actually present an inflammation caused by the presence of cancer cells.

Another point deserving attention is how cancer cells reach the brain or its membranes. Kaufman⁷ pointed out that when the metastasis occurs by way of the blood stream, the brain tissue is principally

11. Oppenheim, H.: Ueber Hirnsymptome bei Carcinomatose ohne nachweisbare Veränderungen im Gehirn, *Charité-Ann.* **13**:335, 1888.

12. Nonne, M.: Discussion of Saenger's Cases in *Neurol. Centralbl.*, 1900, p. 187.

13. Siefert, E.: *München. med. Wchnschr.*, May 20, 1902, p. 826.

14. Westenhöfer: (a) Pachymeningitis carcinomatosa hemorrhagica interna productiva, *Virchows Arch. f. path. Anat.* **175**: 1904. (b) *Deutsch. med. Wchnschr.*, 1903, No. 46; *Soc. Proc.*, p. 359.

15. Dahmen, Z.: Pachymeningitis carcinomatosa, *Ztschr. f. Krebsforsch.* **3**:300, 1905.

16. Lissauer, Max: Zur Kenntniss der Meningitis carcinomatosa, *Deutsch. med. Wchnschr.* **37**:16 (Jan. 5) 1911.

17. Saxer: Ueber dem Bilde einer Meningitis verlaufende Carcinomatöse Erkrankung der Gehirnhäute, *Verhandl. der deutsch. path. Gesellsch.* **5**:161, 1903.

18. Scholz, W.: Meningitis carcinomatosa, *Wien. klin. Wchnschr.*, 1905, No. 47, p. 1231.

19. Stadelman, E.: *Berl. klin. Wchnschr.*, 1908, No. 51, p. 2262.

20. Krause: Discussed in *Deutsch. med. Wchnschr.*, 1903, No. 46, *Soc. Proc.*, p. 359.

21. Schwarz and Bartels: *Deutsch. Ztschr. f. Nervenhe.* **42**:85, 1911.

affected, but when it travels through the lymphatics the meninges become involved. But he does not give the precise mode of invasion of the intracranial spaces. These two problems—the reactive phenomena in the meninges to the presence of cancer cells, and the character of the meningeal involvement—I have studied in the following case.

REPORT OF CASE

History.—A woman, aged 40, housewife, entered Cook County Hospital on the surgical service of Dr. Cubbins, April 5, 1918, with a history of some malignancy of her left breast which had been removed a year previously. About six months later a small solitary gland which appeared in the left axilla was removed. Four months after the last operation she started to complain of severe headache which was constant and accompanied by nausea and vomiting. The vomiting had no relation to meals and was never bloody or coffee-ground in character. She also complained of numbness in the left arm and right corner of the mouth. Other diseases were denied. Her family history was negative.

Examination.—Examination revealed a well nourished, white woman, with surgical scars in the left chest and left axilla. Tumor masses, cervical or axillary adenopathies were not found. The skin, tendon and pupillary reflexes were normal and sensibility was unimpaired except over a small area below the right corner of the mouth, which was analgesic. Vision was 10/10 in the left, 4/10 in the right eye; the fundi were normal. The pharynx, larynx and nasal accessory sinuses were also normal. Neither were there any abnormalities of the genito-urinary organs, speech, mentality, gait, etc.

Course.—After a few days the patient was transferred to the medical service of Dr. Frederick Tice. There she began to complain of severe pain in the epigastrium, about two hours after meals, and slight drooping of the right eyelid set in, with convergent strabismus. The ptosis progressed, the fundi showed a beginning papilledema, the numbness spread over the right temporal region, cheeks and eyes, and the convergent strabismus became more marked. The spinal fluid was under increased pressure, of normal color, with three lymphocytes per cubic millimeter, and positive Nonne. The urine contained no albumin, but showed epithelial cells. Roentgen examination of the stomach and sella turcica was negative. Test meals showed no gastric trouble and a brain tumor of indefinite location was suspected.

Operation.—May 4, 1918, that is, a month after the patient entered the hospital, a decompression operation was done by Dr. Carl Meyer. The dura was found thickened and covered with nodules. One of them was removed and proved to be, on microscopic examination, a carcinoma. A particle from the amputated region of the breast also was removed and likewise proved to be carcinomatous (alveolar). Three weeks after the operation the patient died.

Necropsy.—The postmortem by Dr. John Nuzum revealed, among other things, primary medullary carcinoma of the left breast, secondary carcinoma of the axillary, mediastinal and anterior cervical lymph glands, carcinosis of the visceral and parietal pleura, secondary carcinoma of the liver, left suprarenal body, metastases of the meninges . . . recent surgical trephine defect in the right temporal and parietal bones, etc.

Further examination of the brain showed the right hemisphere covered by an apparently thickened dura which was loosely attached to the pia and easily removable. The thickness of the dura was about a quarter inch over the parietal region, gradually decreasing toward the frontal and occipital lobes. The outer surface of the thickened dura was somewhat rough in places because of the nodules, while the inner surface was represented by a pseudomembrane that consisted of numerous nodules of various sizes. Some of the nodules were colorless, some hemorrhagic. The pseudomembrane was solidly merged with the dura, from which it easily could be distinguished even with the naked eye, but from which it could be separated only with a very sharp knife. The vessels of the dura were much congested, distended and quite prominent. The pia on the same (right) side was very opaque, somewhat thickened, especially over the sulci, showed many distended veins, but no roughness of the surface, no hemorrhages, no nodules, no adhesions to the dura or to the adjacent portions of the brain. The cerebral sulci were not distended, the convolutions not flattened. The base of the brain, the cerebellum and the basilar nerves showed no abnormalities. In marked contrast to these findings, there was nothing abnormal in the left dura, left pia-arachnoid, and various sections through the hemispheres revealed nothing pathologic.

Microscopic Examination.—The microscopic examination covered various portions of the diseased dura, pia-arachnoid, brain tissue proper, the basal pia-arachnoid surrounding the left third nerve, both sixth nerves, as well as similar portions of the healthy side of the brain and its coverings. The celloidin and frozen sections were stained with toluidin blue, Van Gieson, hematoxylin-eosin, Herxheimer and Mann (Alzheimer Method V). The dura changes were studied on transverse and surface sections.

In the neighborhood of the longitudinal sinus (Fig. 1) the dura showed, on transverse sections, a practically normal structure, namely, numerous lacunae and interspaces between the connective tissue fibers. The latter showed distinct nuclei in the form of oval bodies which could easily be distinguished from other formations to be described later. The connective tissue separating the lacunae exhibited no pathologic elements, while the interspaces were invariably packed with red cells, large masses of "epithelial" cells and so-called "gitter" cells. Interspaces free from any contents were exceptionally rare, in contrast to the lacunae which, as I said, were always empty and devoid of any contents. The deeper layers of the dura and the pseudomembrane itself appeared areolar, exhibiting numerous vacuoles formed by connective tissue meshes and packed with conglomerations of cancer cells, large necrotic masses, and fibrin.

The carcinomatous cells usually formed distinct foci, were often blended with each other, forming one mass of cytoplasm containing sometimes as many as eight or ten nuclei (giant cancer cells). Some of the cells showed a broken-up cytoplasm which occasionally appeared vacuolated, with a dislocated, chromatin-rich nucleus. In many cells even the nucleus was broken up into small granules, and in some the nucleus was totally lacking. Some cells contained granules of hemoglobin and when stained with scarlet red showed large quantities of fat globules. The necrotic masses were very large, appeared homogeneous and stained badly, the cell bodies and their nuclei being very indistinct. Scarlet red stain showed in them also the presence of fat. Fibrin was present in many vacuoles, together with hemorrhagic foci, or scattered red blood cells.

as in the dura, blended into giant cells or formed distinct foci. Many cells exhibited vacuoles, mostly filled with pigment granules, which were also frequently found over the connective tissue stroma. Other cells much resembled so-called macrophages, were of larger size and contained several distinct cysts with a dislocated flattened nucleus pushed to the periphery. Some cells were very pale, their cytoplasm converted into one large vacuole, the edges torn or broken up, the nucleus hardly visible. Cells were also encountered without any traces of a nucleus. While some of such cell fragments may be looked on as the result of cutting the sections, that is, have been divided by the knife, others may be considered as degenerated or disintegrated cell bodies.



Fig. 2.—Surface (horizontal) section of the dura. The interspaces between the bundles of connective tissue fibers are packed with cancer cells. Free spaces between the latter and the walls are clearly seen. Magnification 120 diameters. Van Gieson stain.

In addition to these degenerated or broken-up cells and macrophages, there could be seen a great number of "gitter cells" and plasma cells. The latter were freely scattered in the meshes of the connective tissue and could easily be recognized from their characteristic nucleus with its spoke-like arrangement of the chromatin, its excentric location and metachromatic cytoplasm frequently containing a halo. These cells were of unusually large size and often contained two nuclei.

The pia vessels were not proliferated, neither were they distended or infiltrated, but occasionally were thrombosed. Their walls, especially the

adventitia, were thickened but without any distended perivascular lymph spaces of Virchow-Robin. The connective tissue surrounding the vessels and elsewhere showed no fibroblasts, no exudation, the only pathologic phenomena, aside from the cancer cells, having been the macrophages, plasma cells and "gitter" cells. Though the last three forms of cells occur in various forms of acute meningitis, yet the absence in this case of vascular phenomena would make the diagnosis of carcinomatous meningitis rather problematic. On the whole, the pia changes were similar to those of the dura where the reactive phenomena were even less pronounced than in the pia; for instance, there was total absence of plasma cells.

The examination of the brain substance proper revealed an abundance of vessels and capillaries with densely stained endothelium and many so-called rod-like cells ("Stäbchenzellen") in the adventitial layer, but total absence of perivascular infiltration (Fig. 3).

The ganglion cells were greatly swollen, bottle or pear shaped, showed no Nissl bodies; their cytoplasm was lattice-like, or reticular in appearance, the processes well stained, and the nucleus pale and dislocated. Some cells were disintegrated and invaded by glia cells; that is, showed the phenomenon of neuronphagia. The glia cells were markedly proliferated, poor in protoplasm and contained a pale network of chromatin. In the cortical and sub-cortical areas the glia was distinctly reticular in appearance, showed a glia reticulum, and in some sections the brain tissue exhibited large perivascular and pericellular spaces, giving the section the appearance of so-called *état criblé*. Nowhere could any cancer cells be found in the brain tissue. Some portions of the brain, as the motor area, presented only glia changes, and slight parenchymatous or ganglion cell changes, while in other portions both were pronounced.

Of the cranial nerves the left third and both sixth nerves were examined with hematoxylin-eosin, Van Gieson and Alzheimer-Mann methods, and found practically normal, but the pia arachnoid around them was found slightly infiltrated, and, like the corresponding membranes over the cortex, showed complete absence of vascular changes.

In fact, all the membranes, including the dura, in spite of excessive cancerous infiltration (Fig. 3) behaved rather passively. The invaders multiply in their meshes and tissue spaces, but soon perish, becoming converted into lipid substances or forming necrotic masses. There was some phagocytic activity displayed in the pia by the macrophages which pick up the broken up elements converting them into fat-like substances which subsequently are carried away by the "gitter" cells. Yet a diagnosis of meningitis, in the absence of vascular changes, is hardly justified. On the other hand, the brain substance proper exhibited marked parenchymatous changes combined with proliferation of the capillaries, of the glia nuclei and, what is more significant, showed a definite so-called glia reticulum which should be looked on, in my opinion, as specific for encephalitis.²² The encephalitis would, perhaps, account for various nerve symptoms such as paralysis and

22. Hassin, G. B., and Bloch, L.: Trichnosis Complicated by Encephalitis, Med. Rec. 91:537 (March 17) 1917.

anesthesias, which may be caused by the absorption of toxins produced by the cancer cells (Oppenheim¹¹) or by the absorption of necrotic masses.

The cancerous infiltration of the subdural and subarachnoid spaces speaks for a connection existing between these spaces and the periphery; in the case under discussion, with the infiltrated glands of the neck. That such connection actually exists, was proved experimentally as long as fifty years ago by Key and Retzius,²³ and since then by numerous other workers. It would be proper to inquire how these

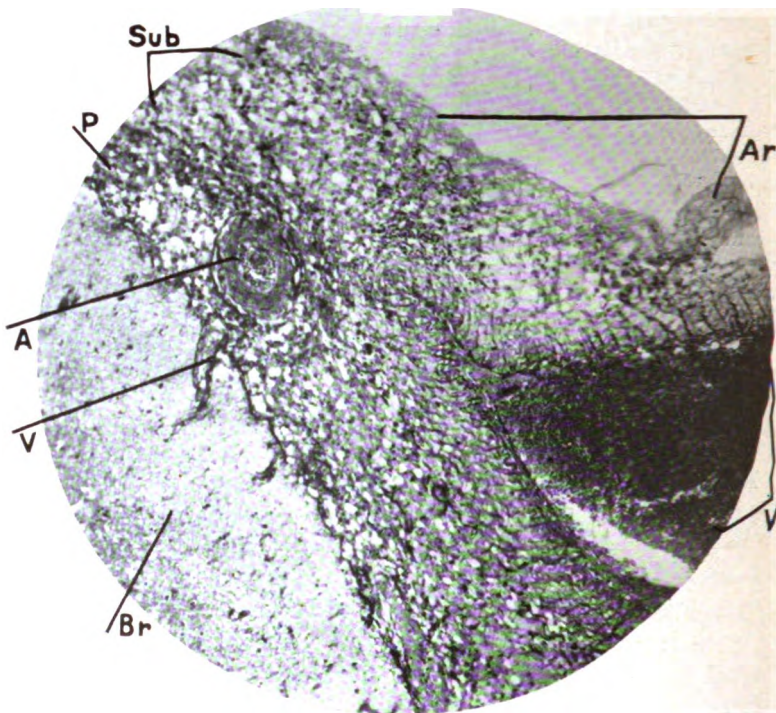


Fig. 3.—Transverse section through the arachnoid (*Ar*), Pia (*P*) membranes, subarachnoid (*Sub*) space, and brain (*Br*) tissue. *V*, a large thrombosed vein; *A*, artery; *v*, a smaller vessel given up by the pia. All the vessels show lack of perivascular infiltration. The numerous small black spots in the brain substance are proliferated capillaries. Magnification 80 diameters. Toluidin blue stain.

elements reached the various structures of the meninges; what pathways they had travelled from the periphery and within the meninges themselves. This problem has not been touched in the numerous

23. Key and Retzius: (a) Abstr. in *Centralbl. f. med. Wissensch.*, 1871, p. 514; (b) *Studien in der Anatomie des Nervensystems und des Bindegewebes* 1: 1875.

reports of carcinoma of the nervous system, except the brief assertion of Kaufman⁷ that the meninges are reached by metastases through the lymphatics. If the cerebral membranes and the brain tissue possessed lymphatics, the mode of cancer cell transport to the nervous system would be quite simple. But there are no lymph vessels in the central nervous system²⁴ through which the fluid from the brain and its membranes can be drained, yet it is done in the most effective manner. This question was recently ably taken up by Weed,²⁵ whose brilliant experiments conclusively show that the cerebrospinal fluid flows from the subdural or subarachnoid space down to the corresponding, so-called perineural spaces of some cranial nerves (olfactory, trigeminal, hypoglossus), from which points it reaches through the tissue spaces the lymph vessels of the neck. Weed thus fully confirmed the earliest findings and observations of Key and Retzius,²³ Michel,²⁶ Schwalbe,²⁷ Quincke²⁸ and others. "The fluid," he says, "thus reaches the true lymphatic vessel only outside of the dura and of the cranium."

Assuming that cancer cells were a substance injected into the lymphatics, we must picture to ourselves the same pathway, but in an opposite direction. The cancer cells would have to travel from the lymph glands of the neck through the lymph vessels, tissue spaces, perineural spaces and finally reach the subarachnoid space. Then we must assume a backward or a retrograde flow of the lymph current, namely, from the neck to the brain, as otherwise it would be utterly impossible to explain the transportation of the cancer cells from the periphery. Recklinghausen²⁹ repeatedly advocated such a mode of metastasis, naming it "retrograde transportation of the cancer cells, in spite of the valves."

In a similar manner, that is, by way of a backward flow of the lymph from the infected cervical glands, were the cancer cells carried also to the subdural space.

24. Poirier: *Lymphatics*, English Edition, 1904, p. 263. Sabin, Florence R.: (a) Development of the Lymphatic System; in Keibel-Mall's *Manual of Human Embryology*, 2: 1912; (b) Harvey Lectures, 1915-1916, Series 11 (*The Method of Growth of the Lymphatic System*).

25. Weed, L. H.: (a) *Studies on Cerebrospinal Fluid* (Contributions II, III and IV, J. M. Res., 1914, No. 1; (b) *An Anatomical Consideration of the Cerebrospinal Fluid*, Anat. Rec. 12: (May) 1917.

26. Michel: *Berichte über die Verhandl. der Königl. Sächs. Gesellsch. d. Wissensch. z. Leipzig* 24:331, 1872.

27. Schwalbe, G.: *Arch. f. mikrosk. Anat.* 6: 1870.

28. Quincke, H.: *Zur Physiologie der Cerebrospinalen Flüssigkeit*, Arch. f. Anat. u. Physiol., 1872, p. 152.

29. Recklinghausen: (a) *Wien. klin. Wchnschr.*, 1897, No. 14; (b) *Verhandl. d. deutsch. path. Gesellsch.* 5:167, 1903.

The latter, like the subarachnoid space, is present around each of the cranial nerves where they emerge from the cranium, running along them to various distances. In some nerves, for instance, the hypoglossus, it follows the latter's smallest ramifications, even as far as the tongue. In other words, each cranial nerve on leaving the skull cavity receives a covering, a sheath, from the dura, beneath which the arachnoid membrane is represented by another covering. Between these two membranes is the subdural space following the course of the nerve (Key and Retzius). Sooner or later these two membranes become blended, forming the so-called perineural sheath. Any substance injected into the subdural space, like Richardson blue, prussian blue, etc., easily reaches the lymph glands of the neck. Invasion of these perineural spaces, as Sabin calls them, by cancer cells while they run in the infected region will of course result in contamination of their prolongations, the subdural or subarachnoid space. Each may become involved independently of the other, along their own channels. their prolongations in the neck. That this actually occurred in our case is probable because the dura was loosely attached to the pia-arachnoid, the latter was perfectly smooth and showed no adhesions, which would have been present if the cells had traveled from the subdural space to the arachnoid or vice versa. These two spaces are closed formations, absolutely separate and independent of each other. Neither Key and Retzius, nor Weed were able to show the existence of any connection between the subdural and subarachnoid spaces. The contents of the latter are the product of the choroid plexus or of the perivascular so-called lymph spaces, those of the subdural space probably the product of the mesothelial cells of the dura proper (Weed). These cavities do not pass anything through their linings, unless high pressure is used (as was probably the case in the experiments of Quincke, who admitted a possible passage of cinnabar from the subdural into the subarachnoid space).

Evidently the subdural space is connected with the so-called dural interspaces (Fig. 2). The latter are generally looked on as lymph spaces, which is denied by Sabin²⁴ and Weed,²⁵ but were successfully injected from the subdural and subarachnoid spaces by Key-Retzius, Michel and others. At any rate, whether tissue spaces or lymph spaces, they are in communication with the subdural space, as in no other way could the cells reach them. To assume that the contents of the interspaces grew from the mesothelial cells by which they are lined or from the cells that normally fill up these interspaces known as arachnoid cell nests (Weed), is illogical, as in our case, the cells of the interspaces are identical with those of the subdural space and are lying freely separated from their walls (Fig. 2). On the other hand,

the lacunae (Fig. 1) were always devoid of contents. In none of them, in spite of the most diligent search could a single cancer cell be found. They were also free of contents in the injection specimens of Key-Retzius and of Weed.^{25-a}

Scattered near the lacunar region are so-called Pacchionian bodies (Fig. 1), or hypertrophied villi, as Weed calls them; formations through which the spinal fluid filters, thus forming one, probably the principle, avenue of escape of this fluid from the subarachnoid space. In some of my specimens, these bodies were surrounded by masses of cancer cells or necrotic foci, and even within the bodies themselves cancer cells could be seen, though in very small numbers (Fig. 1). This would speak for the correctness of the opinion that the villi or Pacchionian granulations serve the purpose of eliminating the contents of the subarachnoid and subdural spaces.

As noted in the foregoing, the brain tissue showed no cancer cells. In spite of an enormous vascularization, the adventitial spaces of Virchow-Robin and the perivascular spaces of His were totally free from cancer elements. The Virchow-Robin spaces were clearly defined and described by Robin,³⁰ in 1859, though briefly outlined by Virchow in 1851.³¹ They are spaces between the media and adventitia, while the spaces of His are located between adventitia and the brain tissue.³² When excessively developed they produce what Durand Fardel called *état criblé*.³³ The spaces of Virchow-Robin are connected with subarachnoid space, the His spaces with the epicerebral space, situated according to His between the brain tissue and the pia. While Virchow-Robin spaces are universally recognized as actually existing formations, the His spaces as well as the epicerebral space and the *état criblé* are looked on as artefacts. This question I have discussed elsewhere,²² and here wish merely to note that in my case all these formations were devoid of contents and that my findings do not speak for or against the views of His and his followers. The absence of contents from the Virchow-Robin spaces, however, is of great significance. Their contents are drained by the subarachnoid space towards which they flow from the brain tissue. Were the current *away* from the subarachnoid space *towards* the brain, toward its lymph spaces, we should expect in my case the latter to be filled

30. Robin, Charles: Recherches sur quelques particularités de la structure des capillaires de l'encéphale, Jour. de la physiol. 2:537, 1859.

31. Virchow, R.: Ueber die Erweiterung kleinerer Gefässe, Virchow's Arch. f. path. Anat. 3:445, 1851.

32. His, W.: Ueber ein perivascular Canalsystem in den nervösen Centralorganen und über dessen Beziehungen zum Lymphsystem, Ztschr. f. Wissensch. Zool. 15:127, 1865.

33. Durand-Fardel: Les maladies des vieillards, Paris, Ed. 2, 1874, p. 121.

with cancer cells. This fact is again in accord with the conclusions of Key-Retzius and Weed, that the contents of the subarachnoid space come from within the brain.

The few points outlined demonstrate the scientific value of cases like the one under discussion, in studying the connections of the large cerebral spaces with each other, with the periphery and with the brain tissue proper. These questions are not only of theoretical, but also of practical value, for instance, in helping properly to estimate the value of intraspinal arsphenamin therapy (Strauss³⁴). The foregoing anatomic questions have been attracting the attention of the ablest investigators for the last fifty years, and their solution was attempted by means of injection of various coloring substances (Richardson blue, prussian blue, cinnabar, tripan blue, fuchsin, plain mercury). In this case the injection was, as it were, done with cancer cells, and not by hands, but by nature herself, and must, therefore, be considered a much superior experiment and of greater scientific value.

In conclusion I wish to note that of the numerous staining methods used the most valuable proved to be Herxheimer's method of scarlet red, which allows of easy tracing of the epithelial, namely, the cancer cells loaded with red granules, along their various courses.

31 North State Street.

34. Kaliski, D., and Strauss, I.: On Syphilis of the Nervous System, *Am. J. Syphilis* 2:609 (Oct.) 1918.

A CASE OF MONGOLISM IN ONE OF TWINS *

HAROLD SWANBERG, M.D., AND H. A. HAYNES, M.D.

LAPEER, MICH.

The case we wish to report is the occurrence of Mongolian imbecility in one of twins, the normal child being distinctly above the average in intelligence. Since twins are subject to identical conditions from conception to birth, and usually enjoy practically the same environment until adolescence, the rare occurrence of Mongolism in one of them permits certain inferences relative to the etiology of this form of feeble-mindedness. A brief résumé of the more pertinent facts concerning Mongolian feeble-mindedness is appended, together with a review of the literature of Mongolism in twins.

RÉSUMÉ OF MONGOLISM

One of the most clearly defined and best known types of feeble-mindedness is that first designated as the Mongolian, Kalmuc or Tartar variety by J. D. Langdon Down¹ in 1866, so called from their facial resemblance to members of the Mongolian race. Tredgold² states that with the possible exception of the tongue, there are no physical signs that are pathognomonic of the condition, for all of the other anomalies present are seen in other types of feeble-mindedness. However, it is the particular combination of anomalies which makes the Mongolian type so distinctive; those most important and frequently present being the small brachycephalic skull; small stature; obliquely set eyelids (hence the name Mongolian); large transversely fissured tongue; short, broad hands and feet; stubby fingers and toes; peculiar shortening and incurving of little finger (Telford-Smith finger); large cleft between the great toe and the second toe; hypermobility of the joints; defective speech; dry, rough skin, especially coarse on the extremities, and poor circulation. They are happy, smiling, good-natured, amiable, active, imitative, easily managed, and nearly always imbeciles, therefore possessing a mental age which corresponds to normal children of between 3 and 7 years. Various authorities state that this group comprises from 0.9 to 10 per cent. of all feeble-minded;

* From the Research Department, Michigan Home and Training School (Michigan State Institution for Feeble-minded), Lapeer, Mich.

* To economize space, the genealogical table and one photograph are omitted from THE ARCHIVES. The complete article appears in the author's reprints.

1. Down, J. L.: Clinical Lectures and Reports, London Hospital, 1866, p. 259.

2. Tredgold, A. F.: Mental Deficiency, Ed. 2, 1914, p. 211.

however, the minimum figure is too low. Statistics of feeble-minded institutions show that from 2 to 5 per cent. of all admissions are of the Mongolian type, and since these cases can easily be managed at home, they are probably more numerous than these figures indicate. Goddard³ estimates there are between 200,000 and 300,000 feeble-minded in the United States. If we accept these figures there are probably between 5,000 and 15,000 cases of Mongolian feeble-mindedness in this country.

The etiology of at least two-thirds of the cases of feeble-mindedness is hereditary, due to defective germ plasm, that is, one or both parents are feeble-minded, or there is a definite history of feeble-mindedness in the ancestry. Neuropathic heredity, injuries affecting the brain before or at the time of birth, traumatism to the brain in early childhood, and various pathologic conditions of the brain, as meningitis, cerebral hemorrhage, etc., during the early years of life, are the etiologic factors in the cases not covered by defective germ plasm. Mongolian feeble-mindedness is an exception, however, in that the etiology is unknown. As a rule, Mongols occur in the better families, there being but the one defective which is usually the first or last child born. The opinion of virtually all who have studied the condition is that it is due to something which interferes with prenatal development, and that the adequate cause is to be sought in the condition of the mother during pregnancy. Either uterine exhaustion, whereby the mother is not able to bring the child to full development (as seen when the child is the first born, the mother being very young, or where the child is the last born in a large family, or when the mother is nearing the menopause at the time of birth of the child) or some severe physical or mental shock to the mother which may have temporarily interfered with the procreative function, seem the most tenable theories. Vital exhaustion of either or both parents is regarded by some as the etiologic factor.

LITERATURE OF MONGOLISM IN TWINS

A careful review of the American and English and a partial review of the remaining literature pertaining to Mongolism in twins has been made. The following cases have been reported:

Hjorth⁴ reports the occurrence of Mongolian feeble-mindedness in twins, each presenting the specific characteristics. The father was a day laborer and was 41 years of age at the birth of the children, the mother 42. These children were the eighth and ninth in a family of

3. Goddard, H. H.: Reference Handbook of the Medical Sciences, Ed. 3. 6:384, 1916.

4. Hjorth, Bodil: *Nyt Tidsskrift for Abnormvaesenet*, No. 9, 1906.

ten. This is the only case reported that we have been able to find of the occurrence of definite Mongolism in both twins.

McKee,⁵ in reporting fourteen cases of Mongolism of which one was in twins, states only that "one baby was the smaller of twins." Nothing is mentioned concerning the other child, but it is evident that it was not a Mongol.

Shuttleworth⁶ states, "Among my illustrations I have the pleasure of showing you two remarkably fine photographs of twin children (boy and girl) from Melbourne, one (boy) normal, the other (girl) a Mongolian imbecile, for which I am indebted to Dr. A. Jeffreys Wood of that city. . . . The case of twin pregnancy with offspring of different sex, the boy normal, the girl a Mongolian imbecile, is unique in my experience."

AUTHORS' CASE

Family History.—The parents of our patient are both collegiate graduates and highly respectable people. The father, now 50 years of age, married at 26, but on account of very poor health at that time, had to give up a confining position to get out of doors. His condition was diagnosed as pleurisy, tubercular origin suspected, and a grave prognosis given. He took up farming in order to build up his health and continued at this for many years. At present he enjoys fair health and his wife describes him as being "tall, slim, very nervous and lacking vitality." The mother, at present 53 years of age, has always enjoyed good health. She married at 29. As a result of this marriage there have been five children (two being twins) and two miscarriages. The oldest child, a girl of 23 years, is in fair health; the next, a girl of 21, is in excellent health. Both girls are brilliant students in one of our large universities. The next child is a boy of 20, who has tuberculosis. At present he is farming as his father did when similarly ill. The next pregnancy resulted in a miscarriage. Following this the twins were born, now 17 years of age, one being normal, the other a Mongolian imbecile. Another miscarriage followed the birth of the twins.

We have been fortunate in securing an excellent genealogy of both the paternal and maternal sides of this family. In nearly 200 known blood relatives on both sides, representing five generations for the paternal and four for the maternal side, no cases of feeble-mindedness have been established, except the one under consideration. There is one case of insanity—a religious mania—which affected a sister of our child's grandmother on the maternal side. There is one case of alcoholism which occurred in the maternal grandfather. The only tuberculosis is on the paternal side. Our patient's father in all probability had tuberculosis, the brother has it, an uncle recovered from it and the great-grandmother died of it. The paternal grandfather and grandmother died at about 80 from senility. The maternal grandfather, who was alcoholic, died suddenly at 45 from "heart trouble," and the grandmother at 78 from "anemia." Two other instances of twinning are seen in the family, both on the maternal side. An uncle of our case was the father of twin boys who were born prematurely, living but a few hours. The great grand-

5. McKee, J. H.: *J. Psycho-Asthenics* 13:43, 1908-1909.

6. Shuttleworth, G. E.: *Brit. M. J.* 2:661 (Sept. 11) 1909.

father had brothers who were twins, and lived to old age. The brothers and sisters of our patient have had excellent school records and the majority of the relatives are above the average in intelligence, two uncles and one aunt being college professors.

Mongolian Twin.—History.—The patient was a boy, aged 17, whose father was 33 and mother 36 at the time of birth of twins who were the last born of a family of five. Mother had no unusual events during the pregnancy except that she frequently fainted. During previous pregnancies she was also subject to syncope, but with the twin gestation it was much more frequent. During the latter part of the pregnancy she suffered from severe pains in the upper part of the abdomen, presumably due to pressure from the fetal parts. The father was in fair health at the time of conception. The labor was normal, no instruments used, and the mother did not suffer more at this time than during her previous deliveries. The normal girl was the first born, weighing 5¼ pounds. She was a "blue baby" according to the mother, the "heart not closing" until the following day. The Mongolian boy was born a half hour after his normal sister. He appeared very pale, and weighed 6½ pounds. Even at birth he had the Mongolian facies, and the fingers were short and chubby in contrast to the long and slender ones of his twin sister. The integument remained soft and did not assume its normal firmness until 3 years of age. He was nursed by the mother and was a very good baby who seldom cried: Teething began at about 8 or 9 months, and was very irregular. He did not commence to walk until 3 years old and did not talk until 6. He never had any bad habits, and at present is quiet, good-natured and easily managed. At 2 years of age he had scarlet fever with otitis media as a complication which left a chronic discharging ear; at 3, measles and pertussis; and later adenoids which were removed. There is no history of convulsions. His schooling has consisted of two years at kindergarten, and three years of special class work for backward children in the public schools. From his 5th to 17th year, he was on thyroid treatment most of the time. The parents believe it has helped him and state his "tongue becomes thicker" and voice more imperfect when he is not taking the drug.

Physical Examination.—His height is 5 feet, and his weight 122 pounds. Musculature and nutrition are good. The head is somewhat small, but of normal shape, the greatest antero-posterior diameter being 6¼ inches, transverse diameter 5¼ inches, and circumference 20½ inches. The fontanelles are closed, the sutures are not palpable, the hair of the head is very abundant, coarse, straight and of red color. The face is freckled, normal symmetry, oval shape and covered with fine hair. The nose is short with nostrils tending to look forward. The upper part of the lobule of each ear is somewhat deformed but hearing is good. The eyes are slightly obliquely placed, the pupils are equal in size and react normally. The lids appear normal, no nystagmus or squint and vision is about 20/40 for each eye. The teeth are in fairly good condition, gums normal, palatal arch high and narrow, tonsils small, no adenoids and lips normal. The tongue is very large, and transversely fissured, papillae enlarged. The mouth is usually partially opened and the speech imperfect. There are no lymph glands palpable in the neck, the thyroid is not enlarged although the neck is large, the circumference being 14¾ inches. The respirations are regular, abdominal type and 20 in frequency. The lungs and heart are normal. The abdomen is protuberant with tendency to an umbilical hernia and there is a lordosis of the lumbar spine. The

three digits backward, could not count backward from twenty to one, could not give similarities between two simple things, could not define objects in terms superior to use, did not know day of week, month or year, could not discriminate between various weights, could not make simple change such as 4 from 10 or 12 from 15 cents, could not use three words in a sentence or give three words that would rhyme with given simple words, and his vocabulary was extremely poor. A more detailed psychologic examination was made and the following is the psychologist's report:

"By the Terman Test our case has a mental age of 6 years and 6 months, which gives him a retardation of 9 years and 6 months. The Seguin Board also gives him a mental age of between 6 and 7 years (Doll's Standardization).

"Throughout all tests the patient shows an ability to discriminate better than that of the average child of his mental age (Seguin, Card Dealing and Healey Picture Puzzles). His fatigue curve is irregular but remarkably well sustained as the curves show. It will be seen that even at the end of thirty minutes he is still making a higher record than during the first minute. The attention is, in general, poor. He is easily distracted and there is a limited amount of fluctuation. The powers of memory, apprehension, and apperception are also poor. In reasoning, with the exception of the comprehension question designed for a child of 8 years, and the most elementary addition problems, there is a complete failure. The will power in general is very good but will doubtless be used without reason. He responds immediately to praise and works with determination and thought such as he is capable of. The patient shows the usual Mongolian power of imitation. There is also a very evident personal pride. He carries himself erect and with chin up, frequently expands his chest to its greatest capacity and looks about for praise. He shows his muscles and readily undertakes anything that will increase his physical strength. Asked what he was doing in the cottage he straightened up, felt his muscle, and replied, 'growing'."

To summarize: The patient shows (1) good discrimination; (2) splendid endurance; (3) from fair to poor attention; (4) poor apprehension; (5) poor apperception; (6) poor memory; (7) very poor reasoning, and (8) a strong but irresponsible will power.

Normal Twin.—The twin of the Mongol is a normal, healthy girl. She has always enjoyed good health and in no way resembles her defective brother. She is 5 feet 5 inches tall and weighs 110 pounds. Her hands and feet are long and slender, her hair is fine and tongue normal. Both physically and mentally she has progressed as any normal child. She started in her school work at 7½ years of age. The first and second grades were completed in one year, as were also the sixth and seventh grades. She was graduated from high school at the age of 17. Her school record has been excellent and if we were to judge her mental ability by this, she could easily be placed above the average in intelligence. In her four years at high school, she never received less than 90 in any subject, and was always among the leaders of her class; her grand average for the four years being 93.4 per cent. Her best subject was mathematics, in which her average was 95.5 per cent. for the four years. This average included all the courses given in that subject.

COMMENT

Many cases of twin births in the feeble-minded have been reported. In most instances both children have been feeble-minded, but in some cases one twin has been feeble-minded while the other enjoyed a

normal mentality. Goddard⁷ reports four such cases. This latter phenomenon can be easily understood if we accept Goddard's⁸ explanation. He states that normal-mindedness is, or at least acts like, a unit character; is dominant and is transmitted in accordance with the Mendelian law of inheritance; feeble-mindedness also behaves like a unit character, is recessive and is, like normal-mindedness, transmitted in Mendelian proportions. If feeble-mindedness is transmitted according to Mendel's law, as there is very good reason to believe, it is easy to explain the difference in the mentality of the twins. Goddard⁹ states: "We have two ova, fertilized by different spermatozoa, each of them subject to whatever possibilities the conditions of the chromosomes warrant. In the one case a "defective" spermatozoan has fertilized a "defective" ovum with the resulting defective offspring. In the other case a normal spermatozoan has fertilized a normal ovum, or else one of the germ cells has been normal and the other "defective," in either case resulting in a normal offspring."

However, the above discussion does not apply to Mongolian feeble-mindedness, for it is an exception, in that it is not hereditary and does not, therefore, follow Mendel's laws. In this respect it is similar to those forms of feeble-mindedness that are due to accidental causes acting before, at, or shortly after birth.

To our knowledge no Mongol has ever become a parent. The genital organs of Mongols appear to develop normally but the sex sense seems to be in abeyance, and some hold they are sterile. Their degree of mental deficiency is so pronounced that marriage is unthought of. This eliminates entirely the possibility of any light being thrown on the etiology by study of the offspring.

There are no grounds for explaining the condition on the basis of birth traumatism, for the physical characteristics of Mongols are already formed before birth. Moreover, in our case the birth was not only normal in every way, no instruments being used, but the normal twin was the first born and would, therefore, be the most likely to suffer from birth traumatism due to the crowded pelvis.

The mother suffered more during this pregnancy than any other, but this is to be expected in twin gestation. In twin pregnancies the mother is more subject to toxic conditions, etc., than when but one fetus is present.

As to the father's health at the time of conception little can be said. He was not robust, but was in much better physical condition

7. Goddard, H. H.: *Feeble-Mindedness: Its Causes and Consequences*, Macmillan Co., New York, 1914, p. 525.

8. Goddard, H. H.: *Ibid.*, p. 548.

9. Goddard, H. H.: *Ibid.*, p. 526.

than at the time of conception of his first child, when he was in a probability tubercular. As both parents are total abstainers, any thought of alcoholism can be eliminated.

Recently there has been an endeavor to explain the etiology of Mongolism on the grounds of congenital syphilis. As a result of serologic tests in thirty-eight Mongols, Stevens^{10, 11} reports a positive Wassermann of the blood serum in 21 per cent., positive Wassermann of the spinal fluid in 18.4 per cent., and in 94.7 per cent. a positive reaction to Lange's gold chlorid test. He states that, "the serologic tests seem to demonstrate beyond question the condition is a result of syphilitic infection." McClelland and Ruh¹² answer Stevens' contentions by criticizing his method of interpreting the tests under discussion. In serologic tests of thirteen Mongols they found negative Wassermann reactions in the blood and spinal fluid and negative Lange's gold chlorid tests in every instance. They state, "from careful anamneses, physical examinations and the laboratory tests now available, it cannot be stated at the present time that Mongolism is due to congenital syphilis." Goddard¹³ states that of twenty-eight Mongolians examined at the Columbus Institute, Ohio, 17.8 per cent gave a positive Wassermann reaction (presumably of the blood serum); and at the Keller Institution in Denmark, no Mongolians gave a positive Wassermann reaction. Of his own cases at Vineland, where two series of examinations were made, and both blood and spinal fluid tested, he states, "in neither of these was the percentage of positives noticeably high." Quoting further from Goddard:

"I have not been able to find any conclusive proof that syphilis in the parents causes feeble-mindedness of any type, to say nothing of Mongolism. . . . To these difficulties in the way of regarding syphilis as the cause of Mongolian imbecility, I think may be properly added the further one that there is no correlation between the instance of Mongolism and syphilis. Mongolian imbecility is, relatively speaking, very rare; syphilis is far from rare. If syphilis is the cause of Mongolian imbecility, are we not compelled to conclude that the latter would be vastly more prevalent than it is?"

The only suggestion of syphilis in our case is the history of miscarriage before and after the birth of the twins. An examination of the blood serum of the defective twin gives a negative Wassermann.

10. Stevens, H. C.: Mongolian Idiocy and Syphilis, *J. A. M. A.* **64**:1636 (May 15) 1915.

11. Stevens, H. C.: The Spinal Fluid in Mongolian Idiocy, *Ibid.* **66**:1373 (April 29) 1916.

12. McClelland, J. E., and Ruh, H. O.: Syphilis as a Factor in Mongolian Idiocy, *J. A. M. A.* **68**:777 (March 10) 1917.

13. Goddard, H. H.: Syphilis as an Etiologic Factor in Mongolian Idiocy, *Ibid.* **68**:1057 (April 7) 1917.

While it is true, syphilis would explain why one child was affected and not the other, the possibility of syphilis explaining all cases of Mongolism is very remote as the work of McClelland, Ruh and Goddard, quoted above, would indicate.

In conclusion, we may state that there is apparently nothing in the history of the mother, father or family to account for the occurrence of Mongolian imbecility in this twin. The defective child had the stigmata of the condition at birth; hence it is, no doubt, due to some congenital factor. Mongolism occurring in one of twins only further convinces us of the obscure etiology of this affliction. Granted, that it is due to an unknown congenital cause, we are at a loss to explain why one child is so affected and the other escapes entirely.

EUNUCHOIDISM

HYMAN CLIMENKO, M.D.

Adjunct Neurologist, Montefiore Hospital; Chief of Neurological Clinic,
Mount Sinai Hospital; Attending Neurologist, Central Neurological
Hospital, Blackwell's Island

AND

ISRAEL STRAUSS, M.D.

Adjunct Neurologist and Associate Neuropathologist, Mount Sinai Hospital;
Attending Neurologist, Montefiore and Brooklyn Jewish Hospitals

NEW YORK

Castration was probably the first surgical operation. If that be correct, then the first surgical operation was not done to relieve human suffering but to satisfy one of the lower human instincts — jealousy. From the time of Semiramis to that of Abdul Hamid, eunuchs have been employed to guard the harems of the wealthy. Lipa Bey¹ vividly describes the barbaric way in which they are castrated and the tortures they undergo as children during and for a long time after this operation. Suffice it to say that according to Hirschfeld,² 80 per cent. of these unfortunates die either immediately during the process of operation or soon after from exhaustion due to pain and infection. Even today some of the children of the Orient are not free from the horrors of castration. In those parts of the East which are under the control of England stringent laws against this barbarism have been enacted.

It must, however, be admitted that even some of the ancient people protested rigidly against this form of brutality. The Hebrews considered castration an unpardonable sin. It was not lawful to castrate even animals. They went so far as not to allow a man whose sexual apparatus was cut off or otherwise mutilated to enter the house of the Lord.³ We are informed, nevertheless, by that linguist and scholar in Semitics, Dr. Alexander Harkavey, that the Jewish kings employed foreign eunuchs in their harems. In fact, the Hebrew word "saris" had a double meaning. It is translated as eunuch and minister of court. Apparently the eunuchs occupied important positions in the courts of Jewish kings.

Human psychology is very strange indeed. We often inflict on ourselves brutalities in the name of ideals. In the eighteenth century

1. Bey, Lipa: *Sexual Problem* 7:674, 1911.

2. Hirschfeld, M.: *Sexual Problem*, 8:81, 1912.

3. Deuteronomy, XXIII, 11.

in Russia and in Roumania arose a Christian sect who thought that through castration they could enter with more ease the gates of Heaven. This sect called themselves Skoptzi in Russia and Lipowaner in Bukarest. They based their belief on the following passage from the New Testament:

For there are some eunuchs which were so born from their mother's womb, and there are some eunuchs which were made eunuchs of men; and there be eunuchs which have made themselves eunuchs for the kingdom of heaven's sake. He that is able to receive it, let him receive it.—Matthew XIX, 12.

LITERATURE

It was among the Skoptzi that Tandler and Gross⁴ made their investigation which has since become classical. The importance of their studies consists mostly in the fact that acquired eunuchoidism very closely resembles or, better still, is almost identical with eunuchoidism, the latter being a congenital condition.

Larey,⁵ in "Campagne d'Egypte," was the first to describe a group of soldiers in Napoleon's army who had high pitched voices, fine skin, smooth and hairless, and no axillary or pubic hair. Their sexual organs were atrophied. For a long time these individuals were looked on as curiosities. Only a good deal later, when the study of the glands of internal secretions became more advanced, the pathology of this condition was taken up more seriously. Brissaud, de Santi, Levi, Anton⁶ and others have shown this condition to be the result of a disturbed pluriglandular activity.

Pierre Marie, through his demonstration that acromegaly is due to pituitary disease, stimulated the study of this gland. Among other things it was shown that the hypophysis has control over the sexual glands. Later, Fröhlich⁷ demonstrated his famous case of dystrophia adipositas genitalia which added a new asset to the knowledge of the pituitary. Soon after Cushing⁸ demonstrated that the anterior lobe was responsible for giantism, hypoplasia of the genitalia and adiposity of the feminine type. Fränkel-Höchwart⁹ demonstrated a patient in whom the power of erection returned after the excision of the pituitary gland. The literature soon became flooded with illustrations of the

4. Tandler, Julius, and Gross, Siegfried: Arch. f. Entwicklungsmechanik der Organismen **30**:236.

5. Larey, Baron: Quoted from W. Falta, Berl. klin. Wchnschr. **49**:1412, 1912.

6. Ibid.

7. Fröhlich, A.: Wien. klin. Rund. **15**: No. 47-48, 1901.

8. Cushing, Harvey: The Pituitary Body, J. B. Lippincott Co., Phila., 1911, p. 178.

9. Fränkel-Höchwart: Quoted from Peretz, Neurol. Centralbl. **29**:1286, 1910.

relation of the pituitary and sexual glands. McIver¹⁰ reported a case of a giant eunuchoid, and ascribes it to hypopituitarism because the sella turcica is deep and the posterior clinoidal processes are well developed. Cocrayne¹¹ reported a young eunuchoid of the fatty type with genu valgum and also calls it hypopituitary. In Langmead's¹² case, one of mixed type of infantilism and dystrophia adiposita genitalia, the author finds the cause in deficiency of pituitary secretion.

Maranon and Pintor¹³ report a case of eunuchoidism of the adiposita-genital type which developed following a bullet wound in the head. The necropsy, performed two years after the injury, showed an interruption of communication between the middle ventricle of the brain and the hypophysis. The hypophysis itself had undergone no direct lesion or compression. A case somewhat similar to this occurred in the Montefiore Hospital.

A girl, aged 11, with double optic atrophy, clinically showed symptoms of a pituitary tumor. The roentgenographic report was as follows: "The sella turcica is greatly enlarged; the clinoid processes are markedly thinned out and partly obliterated. Diagnosis: Neoplasm of the pituitary gland." The same report was issued on more than one occasion independently by two roentgenologists. The history was typical of increased intracranial pressure. At the beginning of the disease the child was markedly emaciated and the entire panniculus was wasted. A few months before her death she suddenly began to put on weight and in a short while she gained 40 pounds. She died from acute ascending paralysis. The necropsy showed a normal hypophysis and no tumor was found anywhere in the brain. Instead, a localized basal tubercular meningitis was present. This constricted the stalk of the hypophysis and thus interfered with its secretion. Symptoms of increased intracranial pressure were due to the internal hydrocephalus produced by the occlusion of the third ventricle. The rapid and enormous gain in weight can be explained by an interference with the proper function of the posterior lobe of the pituitary.

Manirot¹⁴ reports a case of diabetes insipidus, general dystrophy and genital hypoplasia. He found a small sella turcica and attributes the symptoms to a diminution in the function of the hypophysis. Cases of eunuchoidism which resulted primarily from a disease of the pituitary are reported by Ebstein,¹⁵ Weicksel¹⁶ and Mattiolo.¹⁷ St. Chauvet¹⁸ discusses at length the subject of the relation of the pitui-

10. McIver, J.: *J. Nerv. & Ment. Dis.* **45**:443, 1917.

11. Cocrayne, E. A.: *Brit. J. Child. Dis.* **14**:52, 1917.

12. Langmead, F.: *Brit. J. Child. Dis.* **12**:241, 1915.

13. Maranon and Pintor: *Nouv. Iconog. de la Salpêtrière*, No. 4, 1917, p. 185.

14. Manirot, A.: *Arch. de méd. des enfant* **16**:927, 1913.

15. Ebstein, E.: *Mittlg. a. d. Grenezgeb. d. Med. u. Chir.* **25**:441, 1912-1913.

16. Weicksel, J.: *München. med. Wchnschr.*, No. 22, p. 1227, 1914.

17. Mattiolo, G.: *Revista di Patol. Nerv. et Ment.* **19**:513 (Sept.) 1914.

18. St. Chauvet: *L'Infantilism Hypophysure*, Thèse de Paris, 1914.

tary to eunuchoidism as well as to infantilism, while Mouriquand¹⁹ divides the hypophyseal dystrophies into various types. Saenger²⁰ also speaks of the relation of the gonads to the pituitary. Contrary to established principle, as will be seen later, the fifth case of his series developed all the features of a eunuchoid in spite of the fact that the interstitial cells of the testicles were present. On the other hand, Fiessinger and Saurdel²¹ report a case of gonadal atrophy associated with unmistakable signs of diminished thyroid and suprarenal functions. Rebattu and Gravier²² report two eunuchoids, one with visible disturbance of the internal secretion and normal external secretion of the testicles, the other case with disturbed external and internal secretion of the testicles. They attempt to prove that the eunuchoidal characteristics of the individual depend on the absence of the cells of internal secretion in the testicle.

This condition was demonstrated experimentally by Ancel and Bouin,²³ who tied the blood vessels of the vas deferens in young animals, and although these afterward discharged normal spermatozoa, they acquired all the characteristics of castrated animals. One such case is reported in this article. Falta²⁴ discusses eunuchoidism acquired late in life either due to some disease or traumatism attacking the gonads. He tries to show that in these conditions we are dealing with a pluriglandular sclerosis.

Hecht²⁵ reports a case of eunuchoidism in an individual whose penis was very large, but whose testicles were of the size of lima beans. The patient had all of the other characteristics of a eunuchoid. He also showed levulosuria. Hecht comes to the conclusion that the condition is due to a pluriglandular disturbance.

Laignel-Lavastine and Courbon²⁶ report the case of a young soldier, 22 years of age, whose genital organs were normally developed until the age of 21. At that time he was stricken with mumps and a double orchitis. In the course of the next seven months the testicles and penis became markedly atrophied, the breasts increased in size, the abdomen became rounded, erection diminished, and sexual desire and power became weakened. Severe physical exercises in which he

19. Mouriquand, G.: *Paris Medicale* 6:26, 1913.

20. Saenger, A.: *Deutsch. Ztschr. f. Nervenhe.* 51:178, 1914.

21. Fiessinger, Noël, and Sourdél: *Presse méd.*, No. 6, p. 541, 1911.

22. Rebattu, J., and Gravier, L.: *Nouv. Iconog. de la Salpêtrière* 26:257, 1913.

23. Ancel, P., and Bouin, P.: *Compt. rend. Acad. d. sc.* 138:110 (Feb.) 1904.

24. Falta, W.: *Späteunochoidismus und Multipledrüssensklerose*, *Berl. klin. Wchnschr.* 49:1412.

25. Hecht, D.: *J. Nerv. & Ment. Dis.* 38:684, 1911.

26. Laignel-Lavastine and Courbon, P.: *Le Bulletin Med.* 30:408, 1917.

formerly excelled were no longer possible. Briefly, the individual presented a progressive transformation of the secondary sex characteristics into those of the opposite sex.

Butte and Halbeon²⁷ report a case of acquired eunuchoidism in a man 32 years of age. This was due to a syphilitic and gonorrheal infection at 20 which at 32 caused a general sclerosis of the glands of internal secretion. The patient became completely impotent, his testes atrophied, hair and teeth came out, he put on weight, and mentally he was a child. His blood pressure was low. With all that there was not a single sign of organic change in the cerebrospinal system. The authors attribute the syndrome to a sclerosis of all the glands of internal secretion.

Costa²⁸ reports a case of eunuchoidism with giantism in whom he could demonstrate a deficiency of all the glands of internal secretion. The author believes that the original cause was an infection of the testes in early childhood. A case of the same type is also reported by Schwaer.²⁹ Zambaco Pasha³⁰ claims that in eunuchoidism the gonads are not the only glands affected, but that the entire system of glands of internal secretion must be damaged in order to produce the clinical picture of the eunuchoid. Zambaco endeavors to show that each gland has its own definite function, but by damaging one gland all must necessarily be involved. Timme³¹ expresses a similar view. Pende³² reviews the subject of eunuchoidism and lays stress on the relation of the pituitary to the gonads. Goldstein³³ ascribes eunuchoidism to a pluriglandular disturbance. He, however, again repeats the hypothesis of Tandler and Gross that there is a mutually double interaction, inhibitory and acceleratory, between the hypophysis and the gonads. He believes that the anterior lobe, the one responsible for acromegaly, inhibits the sexual apparatus, while the posterior lobe accelerates it, that is, the two lobes are antagonistic to each other. In states of eunuchoidism the balance is lost and abnormalities in growth result which will depend on the predominating lobe. If the anterior lobe leads, there will be an abnormal growth of the skeleton; if the pos-

27. Butte and Halbeon: *Bull. de mém. de la soc. méd. d. Hôp. de Paris* **31**:365, 1915.

28. Costa, S.: *Paris méd.*, No. 43, p. 378, 1913.

29. Schwaer, G.: *Deutsch. med. Wchnschr.* **40**:963, 1914.

30. Pasha, Zambaco: *Les eunoques d'aujourd'hui et ceux de jadis*, Monograph, Paris, 1911, p. 152.

31. Timme, Walter: *A New Polyglandular Compensatory Syndrome*, *Endocrinology* **2**:209, 1918.

32. Pende, N.: *Endocrinology* **1**:924, 1916.

33. Goldstein, Kurt: *Arch. f. Psych. u. Nerven.* **53**:649, 1914.

terior lobe leads we have a fat, bloated individual. This is a very attractive but as yet unproven theory.

More recently Ewing³⁴ has thrown new light on the subject. He epitomizes: "The fate of the human body is not a matter of chance, but in general is controlled by certain intrinsic physical tendencies that are of congenital origin." He teaches through necropsies that eunuchoidism is in many respects akin to status lymphaticus. In his postmortem reports of eunuchoids, Ewing especially emphasizes the hypoplasia of the cardiovascular system and a delicacy of all the blood vessels. This condition of the entire arterial system accounts for the frequent apoplexies in young individuals. The frequent interstitial myocarditis found at necropsies is responsible for the sudden death in these individuals.

A necropsy made by Dr. Harlow Brooks on a eunuchoid at the Montefiore Hospital in 1902 confirms Ewing's statement. We will repeat here a part of the necropsy findings.

Large vessels of abdomen small and sclerotic (the individual, a boy, was 15 years old), especially the smaller trunks. Heart below normal in size, the weight being 9 ounces, with a slight amount of endocarditis. Thyroid small with an incomplete isthmus; weight 8 gm. Tuberculous lymph glands on neck. Liver small. *Spleen very large and asymmetrical. Adrenal bodies small and a portion of right adrenal lost.* The tissue has apparently undergone degeneration in the cortical portion. The kidneys are about one third of their normal size and show pathologic and congenital lobulation. Many cystic bodies are present. The genital organs are very small, a heavy fold of adipose tissue projecting over a very small penis 2 inches long, and covering mons veneris. The prostate is very small. The brain showed primitive sulci; it was small. Optic atrophy was present. Pituitary gland small, no gross lesions.

The individual was a eunuchoid of the fatty type.

More recently Citelli et Caliceti³⁵ report a number of young soldiers with feminine features who suffered mainly from adenoids. Caliceti³⁶ even goes so far as to demonstrate a case of pituitary disease associated with eunuchoidism cured by the removal of adenoids. He confirms the theory of Poppi who claims that all hypophyseal diseases are due to adenoid vegetations. As far as the gross pathology is concerned, particularly the skeleton, we cannot do better than to refer to Tandler and Gross,³⁷ and also Duckworth.³⁸

34. Ewing, James: Military Aspect of Status Lymphaticus, J. A. M. A. **71**:1525 (Nov. 9) 1918.

35. Citehi, S., and Caliceti, P.: Il Policlinico Lezione Pratica **25**:245, 1918.

36. Caliceti, P.: La Pediatria **25**:233, 1918.

37. Tandler, Julius, and Gross, Siegfried: Arch. f. u. Entwicklungsmechanik der Organismen **27**:35, 1909.

38. Duckworth, W. L. H.: J. Anat. & Physiol., 3d Series **2**:30.

DEFINITION OF THE TERM

Clinically, the term eunuchoid was first used by Duckworth and adopted by Tandler and Gross. The latter authors divide the eunuchoids into two classes: (1) tall, slender individuals with abnormally large extremities, and (2) stout, bloated people with accumulations of fat at the upper eyelids, breasts, lower abdomen, *cristae iliae* and

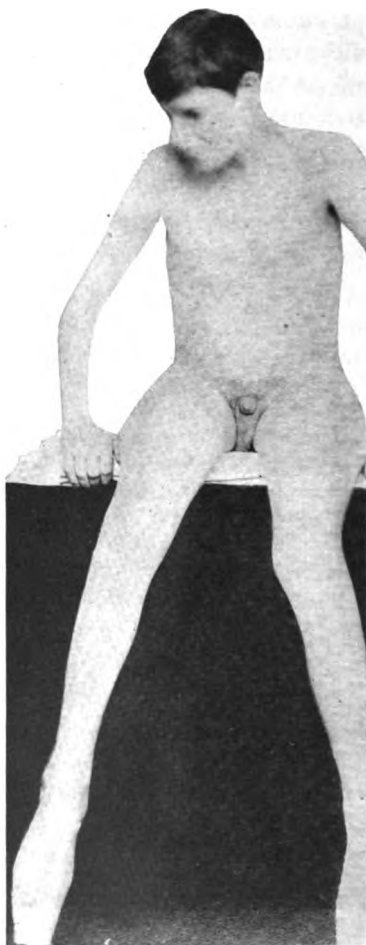


Fig. 1 (Case 1).—Eunuchoid, with spastic paraplegia due to apoplexy in cord.

nates. A number of intervening types are present. The symptomatology of eunuchoidism may be shown by a description of the following cases.

ILLUSTRATIVE CASES

CASE 1 (Fig. 1).—*History*.—A. H. entered the Montefiore Hospital Oct. 8, 1917. Father died at the age of 58 of cancer; seven brothers and sisters living

and well; one sister died in labor. Patient had been married six years and claimed to have had sexual intercourse. He, however, soon left his wife. Present illness dates back ten months prior to his entrance into the Montefiore Hospital. He complained of prickling sensations around the anus and right costal cartilage which lasted for a few days. Suddenly at night he was stricken with paralysis of both lower extremities. He could not pass any urine and had to be catheterized for three weeks. His bladder condition gradually improved, and at time of examination he had perfect control of the urinary sphincter.

Examination.—The patient is 5 feet, 11 inches tall. Circumference of head, 20 inches. From acromion to styloid process of radius, 28 inches. Distance between anterior superior spines, 10 inches; anterior superior spine to internal malleolus, 34 inches; umbilicus to internal malleolus, 36½ inches; umbilicus to symphysis, 7 inches, and suprasternal notch to umbilicus, 12 inches. The patient has the typical appearance of a eunuchoid with pronounced features of feminism. There is an abundant growth of blond hair on the head, but the face is covered only with a whitish lanugo. The skin is smooth, soft, and velvety to the touch; it is of a pinkish hue with a tendency to flush. There is a profuse perspiration pouring down from axillae which are absolutely hairless. The abdomen is well rounded and shows a pigmented middle line. The pelvis is broad with a feminine contour. There is a perfect mons veneris covered with a few straight hairs which stop short in an almost straight line immediately above the mons veneris.

Genitalia: The penis is that of a child of 5 years. It measures 1½ inches from symphysis to meatus urethrae. The scrotum is markedly furrowed in the middle and as the patient lies recumbent it resembles the labia majora of the vulva. The testicles are very small, about the size of small gooseberries. When the scrotum is lifted the perineum is larger in size than the average man's perineum and has a tendency to shape itself into a fourchette. No hairs are to be seen on the perineum.

The lower limbs are feminine in type; they look as if they were chiselled of marble and have a fine pinkish hue. The breasts are well formed and are the size of those of an average girl at puberty. There are accumulations of fat at the lower abdomen and buttocks. The neck is perfectly round and the pomum adami is not visible. Voice is high pitched and feminine in character. Lower chin is somewhat protruded. Abdominal and thoracic viscera are negative.

The patient lies flat on his back being unable to stand or walk. He has a complete syndrome of spastic paraplegia; Babinski sign and other confirmatory great toe reflexes, double clonus, knee jerks and patellar reflexes are very lively. Cremasteric and lower abdominal reflexes not elicitable; upper abdominal reflexes present. While patient is being examined twitching of both lower extremities of the spinal epilepsy type is present. There is an area of hyperalgesia beginning at second lumbar vertebra and extending down to upper buttocks, where it becomes very marked. Here a prick of a pin throws both lower extremities into convulsions. Anteriorly there is a line of hyperalgesia at about the umbilicus and from Poupart's ligament down to the knee on left side and on the right side to the middle of the thigh. From here down to about the middle of legs sensation is intact, then there is anastomosis down to the toes. Analgesia follows the same distribution. There is a marked dissociation of temperature sense in the outlined areas. Vibration sense is absent in both lower extremities.

The upper extremities as well as the cranial nerves showed no abnormalities. There was no nystagmus and the disks were negative. The blood Wassermann test was negative. Cerebrospinal fluid taken on three occasions showed a normal pressure, clear, negative Wassermann, and globulin cells 6 to 8 to the field. The urine showed on one occasion granular and hyaline cells with some albumin; otherwise negative.

After giving 100 gm. of glucose in one hour doses, the blood showed 0.155 per cent. sugar. Urine was passed an hour after ingestion—quantity 160 c.c. and 1 per cent. of glucose. Twenty-four hours later no sugar was seen. The blood showed an average of lymphocyte count 25 per cent.; hemoglobin, 80 per cent.; red blood cells, 4,500,000; white blood cells, 10,000.

Roentgenographic Report.—Skull: spots of irregular bone condensation throughout the frontal and parietal bones; sella normal in size; hyperostosis of posterior clinoid processes. Marked diffuse atrophy in bones of feet. The lower extremities showed a moderately advanced bony rarefaction throughout the intratrochanteric portions of both femora.

Subsequent History.—The patient received practically no medication. He began to improve slowly and steadily and on April 28 we read the following bedside note made by the intern: "Complaints of burning sensation in lower parts of legs. This sensation is especially distressing on prolonged walking." The motor power in his lower extremities markedly improved. In August he left the hospital to return to work. On September 29 he was again seen by one of us. He was working at his trade as a tailor. He still presented the spastic syndrome of paraplegia, but he was able to walk without any great difficulty. A marked improvement was also noticed in his sensory status. Otherwise the condition was unchanged.

Mentality.—The patient was a tailor and his mentality was that of the average tailor of his race and nativity. He could read Yiddish and understood some Hebrew. He spoke English not worse than the average Jewish tailor who has been in America a number of years, having been six years in New York. Simple questions in arithmetic were answered satisfactorily. As to his sexual status he felt a desire for women; he had married and had erections. He believes he had orgasms although there never were any ejaculations. When asked whether he would marry again, he smiled and stated that he had had quite enough of one wife. He is bashful and reserved, his nature soft and mellow. He absolutely refused to be demonstrated at a medical meeting. "God," he said, "has punished me enough. Neither you nor your colleagues can help me. Why should I expose my shame."

An analysis of this case shows that we are dealing with a eunuchoid with marked features of femininity. He is an intermediary type, being both tall and graceful and having the normal eunuchoid accumulation of fat. In spite of the roentgen ray report that the sella turcica is normal, he showed clinically distinct interference with the proper function of the pituitary gland. The lowered sugar tolerance as well as the accumulation of fat speak distinctly for a posterior lobe involvement, while the large and disproportionate skeleton together with hypoplasia of the sexual glands indicate an overactivity of the anterior lobe. The thyroid could not be palpated, but the profuse perspiration, the pronounced vasomotor change, evidenced both in flushes and dermatographia, speak for an involvement of the thyroid and adrenals. We thus have a picture of pluriglandular disturbance.

The neurological syndrome can be explained only on the basis of a hemorrhage into the cord. The sudden onset of complete paraplegia followed by a gradual but steady improvement without medication, cannot be explained by any other condition except hemorrhage. As mentioned above, Ewing describes forms of apoplexies in eunuchoids and attributes them to an abnormally small heart and small walls of arteries. From the paresthesia that existed before the onset of the hemorrhage, we can conclude that there was a minute bleeding initiating the final hemorrhage. The present spasticity can be accounted for by secondary gliosis following the hemorrhage. Gliosis



Fig. 2 (Case 2).—Giant eunuchoid.

in eunuchoids was also reported by Burdels.³⁹ We therefore formulate our conclusion: The patient, a eunuchoid with marked feminism and pluriglandular disturbance, is suffering from a spinal gliosis following hemorrhage into the cord. After carefully searching the literature we could not find another case of apoplexy into the cord in eunuchoids, and came to the conclusion that this is probably the first case of its kind ever reported.

CASE 2 (Fig. 2).—*History*.—D. S., aged 55, entered the Central and Neurological Hospital, Blackwell's Island, on Nov. 13, 1916. He complained of heart disease and inability to work. The patient is of a low grade mentality and no family history was obtainable beyond that he was born in Ireland and

39. Bartels, cited from Ewing.

his parents were farmers. He is a laborer, unmarried, and temperate in his habits, neither smoking nor drinking.

Examination.—The patient is fully 6 feet, 2 inches tall and of the appearance of a giant or atropoid. His head is small, 28 inches in circumference. As he stands he stoops somewhat forward. Double knock-knee, genu valgum, and flat feet. His hands are large and wide (Fig. 3) and spade-like in appearance. The face shows no growth of hair. The skin is yellow or parchment color and thrown into many folds and furrows. His forehead is narrow, lower chin protruded, eyebrows are thin and narrow. The skin over the body is thin and smooth. Chest is narrow with a tendency to pigeon breast. Thyroid

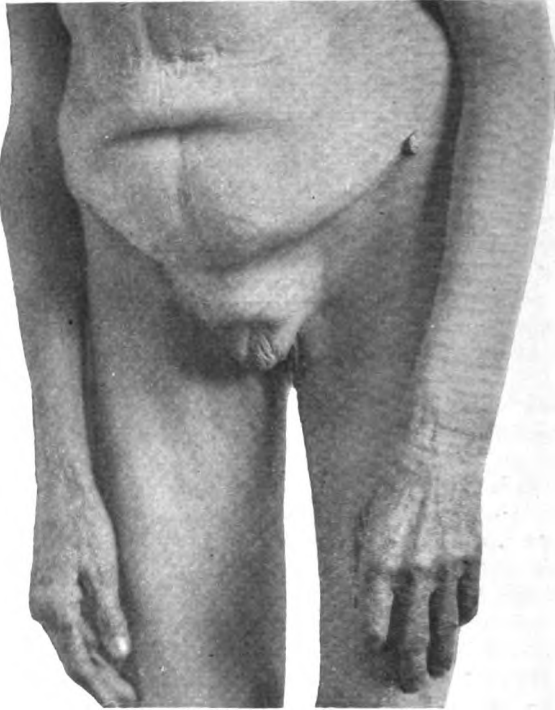


Fig. 3 (Case 2).—Genitalia and hands of eunuchoid.

not palpable. Pomum adami not visible. Distinct brown colored pigmentation over lower part of abdomen. Each pigment spot appears like a plaque and is the size of a lentil. The pelvis is broad, of the female type. Sergeant's line is present.

The prostate was not palpable. His muscular power is greatly diminished. The muscles are flabby and appear atrophic. No electrical changes are found. His reflexes are sluggish, but no symptoms pointing to organic nervous disease is present. Wassermann test of the blood and cerebrospinal fluid is negative. The urine showed a few hyaline and granular casts with some albumin. One hundred gm. of sugar gave a distinct Fehling's reaction in the urine one hour after ingestion. Hemoglobin, 70 per cent.; red blood cells 4,000,000; white blood cells, 15,000; polymorphonuclears, 80 per cent. Some

of the ulcers on the legs were purulent. The heart shows a double systolic apical murmur. There was prolonged expiration and some dulness at both apices. The sputum was negative; blood pressure, 100. His voice was high pitched with some hoarseness. Unfortunately we could not secure an roentgenogram of his skull.

Genitalia: Distinct mons veneris covered with fine crisp gray hair. A small vermiform appendix that has the semblance of a penis and measures $1\frac{1}{2}$ inches. The scrotum is mainly made up of adipose tissue. It is unproportionately large as compared with the penis. It is furrowed in the middle and resembles a vulva. Within each side of the scrotum is a small hard body, the size of a pea, probably a rudimentary testicle. Marked varicosity of lower extremities and ulcerations due to these varicosities.

Mentality.—He can neither read nor write, and is very poor in figures. He knows the days, but has some trouble with the months. In general his mentality is not above that of a child of 6 years. When asked as to his sexual feeling he looked blank and did not seem to comprehend the question well. He is obedient, reserved, not plaintive. When asked to stand before the camera there was no objection as is the case with so many of the eunuchoids.

This is a case of a giant eunuchoid with marked mental deficiency. The skeletal appearance is almost that of an acromegalic. It only differs from this condition in being congenital. Acromegaly is acquired later in life. This together with the low sugar tolerance would justify us in concluding that the pituitary is involved. The general weakness, the peculiar eruption, as well as the low tension, together with Sergeant's white line, would speak of diminished adrenal function. That the adrenals are responsible for infantilism and eunuchoidism is also related by Morlat.⁴⁰ The testicles are certainly not functioning. If we now remember the close relation between the adrenals and thyroid we would say that the thyroid too must necessarily be involved. Therefore the case is the result of a pluriglandular disturbance.

A case of moderate imbecility associated with eunuchoidism where the libido was altogether absent is reported by Schwenkenbecher.⁴¹ The patient was 17 years of age. Penis that of a child of 3, no testicles, no hair, small prostate, thyroid not palpable, small sella turcica, long extremities, separation of epiphysis. Moderate imbecility, kind nature, libido missing, no erections.

CASE 3 (Fig. 4).—*History.*—M. S., aged 25, was born in Russia of Jewish parents. His father died of carcinoma of the stomach. *An older brother was not allowed to land in this country because of his low mentality. His*

40. Morlat, A.: *Infantilisme et Insuffisance surrénale*, Thèse, Paris, 1903. Quoted from B. Onuf. A Study of Eunuchoidism, etc. *Am. J. Dermat.* 16:518, 1912.

41. Schwenkenbecher, A.: *München. med. Wchnschr.* 60:444, 1913.

genitalia were also undeveloped. The patient is the third child, was born normally, breast fed, and had uneventful development until the age of 5. At that time he was stricken with scarlatina and says he was so sick that he could not speak for a number of weeks. At about the age of 10 he suffered from nasal obstruction. Soon after he had frequent urination and

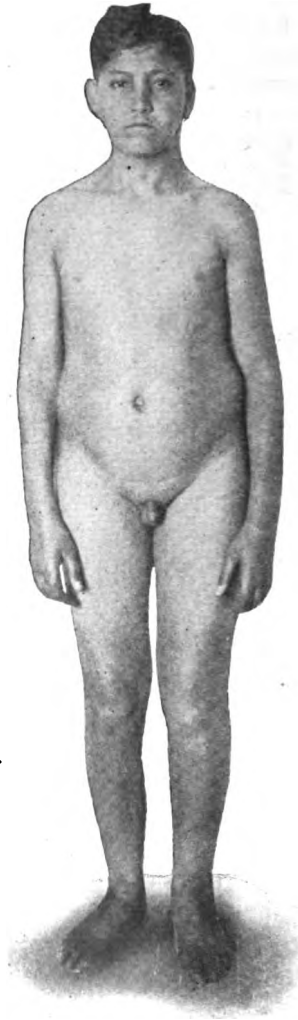


Fig. 4 (Case 3).—Eunuchoid, status thymicolymphaticus.

enuresis. Frequent urination and nycturia, instead of enuresis, are still persistent. He attended a rabbinical school until the age of 12 and was of average brightness. At 18 it was brought to his attention that he had no desire for the opposite sex. It was also at that age that he first noticed that his sexual organs were not developed.

Examination.—He came to the Mt. Sinai Clinic complaining of “nervousness” and frequent urination and nycturia. He is 5 feet, 5 inches tall, and weighs 142 pounds. Circumference of chest at nipples, 34 inches. Circumference of head, 24 inches; upper arm 14½ inches, lower arm 10 inches. The hand measures 7 inches from the middle of a straight line thrown from the tip of the radius to the tip of the middle finger. Between outward superior 12 inches; from anterior superior to lower border of patella, 21½ inches; from there to internal malleolus, 15 inches. Length of foot, 11 inches.



Fig. 5 (Case 3).—Genitalia and thighs of eunuchoid.

As seen from figure 4, his form is that of a young woman. The breasts are well developed. The arms are round and well curved. The buttocks are round, hemispherical in shape. The thighs and legs and arms appear as if chiselled. The head dolichocephalic, thickly covered with jet black hair; face hairless, lower chin protruding, and on the perfectly round neck no pomum adami is visible; thyroid not palpable. The teeth are visibly separated and irregularly set. The posterior pharynx is full of adenoids; the breathing is

therefore through the mouth which is almost always slightly open. The hard palate is high arched. His voice is distinctly feminine with a nasal twang. The entire skin is smooth, soft and glossy. No hair on the axilla. The middle of abdomen is pigmented as seen in some women.

Genitalia: There is a perfectly well formed mons veneris covered with a few short and rarefied hairs ending abruptly at a straight line. The penis (Fig. 5), as well as the scrotum, is that of a child of 5 or 6. It is perfectly well formed, but measures only $1\frac{1}{4}$ inches. The scrotum is masculine in type but miniature in appearance.

Clinical Examination.—No heart lesion was found. There was some dullness present at upper manubrium; abdominal viscera negative; spleen and liver not palpable. Pulse 80 to 70. Blood pressure 110/70. Negative Wassermann reaction in blood and spinal fluid. Urine examination is negative. Blood Examination: Red blood cells, 4,000,000; white blood cells, 10,000; polymorphonuclear cells, 50 per cent.; small lymphocytes, 40 per cent.; large mononuclears, 4 per cent.; eosinophils, 4 per cent.; transitionals, 2 per cent.; hemoglobin, 80 per cent. No sugar was found in the urine following glucose given up to 400 gm. on an empty stomach.

Roentgenographic Report (Fig. 9).—Examination of the skull does not show the sella turcica very plainly but it appears somewhat flattened out and the clinoid processes seem to approach one another, if not almost touching. Examination of the chest shows a shadow at the root of the neck. Otherwise no abnormality is seen in the lungs, aside from marked enlargement of the bronchial lymph nodes.

Mentality.—His mentality is that of the average tailor. He is kind and soft natured. He takes part in the social movements of his class and belongs to some labor organizations. He obeys commands willingly. Has no objection to being demonstrated at medical meetings. He told one of us that he was released by the selective service draft board, but that he would rather fight and be a man than to be in his present condition.

This case is eunuchoid with a typical picture of status lymphaticus. Characteristic in this case is his family history. *A brother suffered from the same condition* which brought out the fact of this being a familial disease. This is mentioned by Ewing and many other writers on the subject. Unlike the findings of Tandler and Gross, Peretz⁴² and many others, this patient has a *very small sella turcica*. He is one of those cases with congenital abnormalities which do not permit the hypophysis to expand in size. The roentgenogram of the chest suggests very plainly the possibility of a persistent thymus. This is still more emphasized by the adenoids and increased lymphatics in the bronchi as well as the rather increased number of lymphocytes in the blood. A. Müntzer⁴³ also speaks of observing a lymphocytosis in eunuchoids.

42. Peretz: Refer to footnote 9.

43. Müntzer, A.: Berl. klin. Wchnschr. 472:2052, 1910.

CASE 4.—History.—W. L., school boy, aged 15, admitted Nov. 9, 1916, to Mt. Sinai Hospital, service of Dr. B. Sachs. The chief complaint was obesity. Mother and father also obese; brother died of convulsions. Patient has always been a fat boy. Up to time of operation for appendectomy in 1913 his weight was 130 pounds and he now weighs 176 pounds. No cardiac, pulmonary or renal symptoms. Enuresis occasionally. He had measles in childhood.

Examination.—There is generalized obesity showing itself on face, chest, abdomen and extremities. Skin soft and white. No axillary hair. Head well formed. Neurological status, negative. Mouth negative except for markedly enlarged tonsils. Chest well formed; expansion good. Heart not enlarged, negative. Pulse equal; good force and tension. Abdomen: scar over appendicular region; no masses. Liver and spleen not palpable.

Genitals: Pubic hair scanty and ends in a straight line (feminine type). Small penis. Testicles very small, size of peas. Dilatation of internal mammary veins in right chest. Persistent thymus. Status thymicolymphaticus.

Roentgenographic Report (Nov. 14, 1916).—The skull shows rather large protruding frontal sinuses, large sphenoidal sinuses, and a marked prognathia of the jaws. At the same time the sella turcica is seen to be rather small. No other abnormality is seen in the skull. In the jaws the third lower molars are seen to be unerupted on both sides and are impacted against the second molars in a way which will interfere completely with their eruption. The third upper molars on both sides are also unerupted but they are not impacted.

COMMENT

In this group of four cases we have a state of a congenital eunuchoidism, three of which, the first, third and fourth, can easily be put into the class of status lymphaticus, the first case giving clinical symptoms of apoplexy into the cord, a condition hitherto unreported, although apoplexies into the brain have been known to exist. The third case shows a sella condition that is also very rare and is contrary to the adopted opinion that in the eunuchoids the sella turcica is enlarged. It probably illustrates the fact that our judgment of the function of the pituitary must not be based on the size of the sella as evidenced through the roentgen ray appearance. The fourth case is a mixed type of eunuchoidism with characteristic fat accumulations and strongly suggestive of status lymphaticus. It will be noted that here also the sella turcica was rather small. The second case is in a class by itself. He resembles the anthropoid much more than does the average human being. His skeletal frame looks as if it belonged to an intermediary stage between the human and the anthropoid. His intelligence is low.

The question of the psychology of the eunuchoid has recently been studied by Sterling,⁴⁴ who divides the eunuchoids into three

44. Sterling, W.: Klin. Stud. u. Den Eunuchoidism, Ztschr. f. d. Gesam. Neurol. u. Psych. 16:235, 1913.

classes: (1) Moderately diminished mentality; (2) imbecility, and (3) parasitic type. The first, third and fourth of our cases are, as regards mentality, normal beings anxious to be useful to themselves and others around them. Our case of imbecilism shows also an inversion to the lower stages in the development of the human race.

One thing can be said about the eunuchoids; all of them lack the masculine earmarks of psychology. They are conspicuous for lack of pugnacity, for their softness of character, weakness, and seeking the protection of others as do women. On the other hand, they lack



Fig. 6 (Case 5).—Acromegalic features.

the attractive part of woman's psychology. If we remember Virchow's aphorism that a woman is only a woman because she has ovaries, we must in our study of eunuchoids admit that whatever is masculine in a man is because of his testicles. Onuf,⁴⁵ who studied the eunuchoids from the standpoint of etiology and classification, also goes into the sociologic aspect, but arrives at no positive conclusion as to the social standard of this class of people.

CASE 5 (Figs. 6 and 7).—History.—R. H., a woman, aged 22, was admitted to the Montefiore Hospital, June 16, 1918. The chief complaint was headache. The family history was negative except for a neurotic taint. The patient is

45. Onuf, B.: A Study of Eunuchoidism, etc., *Am. J. Dermat.* **16**:459, 1912.

married, but has no children. Menstruation began at 14 years, was regular for about six years when it ceased completely. She has had an abscess on the neck, but previously no serious illness.

The present illness which brought her to the hospital began about three years ago with headache localized over the right eye and right ear. For half a year the headache was not so severe, but after that it continued day and night. She never vomited. She had no trouble with eyesight, but believed that hearing on the right side was poor; no buzzing in the ears. Appetite fair, bowels constipated. No pulmonary, cardiac or renal symptoms. Configuration of face changed in one year.



Fig. 7 (Case 5).—Posterior aspect—patient acquiring male shape of buttocks.

Patient noticed that the growth of hair on her legs and lower abdomen increased within a year. Tonsils and adenoids were removed on two occasions, and in the spring of 1916 she had a nasal operation performed, thinking that these minor operations would relieve her headaches. However, no relief was noticed. (The relation of adenoids to pituitary disease has been emphasized above.) The nasal operation was a resection of the cartilaginous and bony septum. There are no pathologic conditions in the nose, but there is a remnant of adenoid tissue in the nasopharynx. The fundi are normal. Blood Examination: Hemoglobin, 75 per cent.; red blood cells, 4,500,000; white blood cells, 10,000; polymorphonuclear cells, 50 per cent.; lymphocytes, 43 per

cent.; eosinophils, 1 per cent.; large mononuclear cells, 1 per cent.; transitionals, 4 per cent.

Physical Examination.—The head and neck were negative. Face: acromegalic; prominent lower jaw, brows and nose; high cheek bones, pasty skin, receding forehead and dry hair. The eyes were normal. The ears were negative externally. Mouth: tongue coated, teeth poor. Cranial nerves normal except a diminished sense of smell. Thyroid not enlarged. Glands: small inguinals palpable. Chest: expansion good; lungs negative anterior and posterior; heart: apex in sixth space, good force and quality, no thrills, action good, no murmurs. Abdomen soft and tympanitic, no masses; slight tenderness over the appendix.

Genitals.—Male distribution of pubic hair; uterus retroverted and retroflexed, small and atrophic. Extremities: Lower limbs: knee jerks and Achilles tendon reflex were present; no clonus, Babinski or Kernig signs; wide distribution of hair over entire legs. Upper limbs: wide distribution of hair on arms; hands have beginning acromegalic appearance, wide fingers and thick skin. The diagnosis of hypophyseal tumor was made and operation was advised. The urinalysis was negative except for diminished sugar tolerance. The blood Wassermann reaction was negative. The breasts were atrophied.

Roentgenographic Report.—Examination of the head shows a very large sella turcica with marked thinning of the anterior and posterior clinoid processes. The jaw is somewhat protruded, but there is no evidence of increased thickness in the bones of the skull. The frontal sinuses are entirely obliterated. The appearance is that of a tumor of the hypophysis.

This case is practically a eunuchoid of the female type developed subsequently to an involvement of the pituitary gland. The acromegalic features practically changed her countenance from a comely girl into the rude masculine type, with protruded eyebrows, well pronounced cheek bones, prognathism of the lower jaw and receding forehead. The color of the face changed from a blond and rosy hue into a dark color with a yellowish reflection. The skin lost all smooth and velvety feeling; it became more rough. Her buttocks have assumed a male contour. Her hands and feet have become large. The growth of hair that developed over her entire body completes the picture of inversion of secondary sexual characteristics. In other words, due to a diseased pituitary, a female has become a eunuchoid and has assumed masculine features.

Roberts,⁴⁶ in his travels in the surroundings of Bombay, observed women whose ovaries were cut out in early childhood. They too had assumed the masculine secondary characteristics. The mutual interrelation of the pituitary and sexual glands is once more illustrated. Our patient was practically castrated by nature interfering with the proper function of the pituitary gland.

46. Roberts: Quoted from St. Chauvet. *L'Infantilisme hypophysure*. Thèse de Paris, 1914.

and must be searched for within a scrotum that is much too large for small testicles. The perineum is partly covered with hair. The prostate is very small. The contour of the buttocks is of the female type. The urinalysis is negative; 400 gm. of sugar give no glycosuria. The Wassermann reaction of the blood is negative. No neurological signs. Normal intelligence. Blood Examination: Red blood cells, 4,000,000; polymorphonuclear cells, 70 per cent.; small lymphocytes, 30 per cent.; large lymphocytes, 5 per cent.; transitional cells, 2 per cent.; eosinophils, 1 per cent.; hemoglobin, 70 per cent. Blood pressure 140/80. Voice high pitched. Seminal fluid shows a small number of sperm

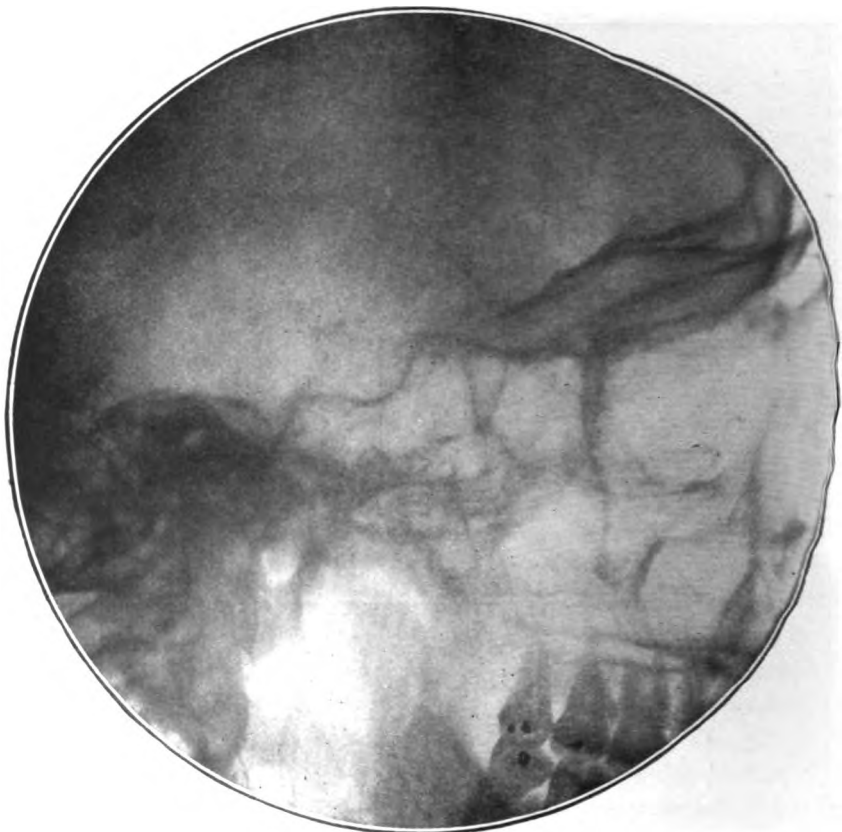


Fig. 9 (Case 6).—Large sella turcica with posterior clinoid processes overshadowing and concretions in the pineal gland.

cells, but not a trace of spermatozoa is found. He has indulged in coitus two and three times a week. While this patient has acquired some feminine features, in the main he is masculine in type.

Roentgenographic Report (Fig. 9).—Large sella with well developed and overshadowing posterior clinoid processes. Calcification of pineal gland.

FUNCTIONS OF THE INTERNAL SECRETIONS

Reports of the relation between the pineal and sexual glands have been made by many reliable authorities. Bailey and Jelliffe⁴⁷ report

47. Bailey, P., and Jelliffe, S. E.: Arch. Int. Med. 8:851 (Dec.) 1911.

This case, however, illustrates another very valuable fact, namely, that the testicles have really a double secretion; an external, the procreative, and an internal which helps to make up the secondary sexual characteristics of the individual. In our patient the external secretion of the testicles was absent, yet he retained in main the secondary sexual characteristics and was able to indulge freely in coitus. The latter was observed by Tandler and Gross in some eunuchs in whom the testicles only were removed. All of our patients, except the imbecile, stated that they had a desire for the opposite sex. Lipa Bey⁵¹ states that in the harem of Abdul Hamid a eunuch killed a young woman out of jealousy. It is, however, difficult to establish whether these people have a real libido.

One could probably interpret as a desire to be like others their apparent yearning for women. Our first case, though possessing only an infantile penis, even married. He wished to have a home. He left his wife, however, when she miscarried for he knew the child was not his. The high pitched voice is peculiar in all these cases. Scherer,⁵² who studied this subject extensively, shows that in eunuchoids true laryngeal cartilages do not ossify, and that the bridge between the two thyroïdal plates is much narrower than in men.

TREATMENT

In Case 2 all sorts of opotherapy were used without results. It is almost needless to say that no treatment in these cases is of any avail. They are finished products and to improve or cure them would mean to create new tissues, an achievement as yet still to be looked for.

The subject of eunuchoidism is fascinating to those interested in the glands of internal secretion. The eunuchoid is *par excellence* a product of deficiency in the adjustment of the entire confederacy of these glands. It is in the eunuchoid that the key to a solution of some of the vital questions in endocrinology will be found.

252 East Broadway—116 West Fifty-Ninth Street.

51. Lipa Bey: Refer to Footnote 1.

52. Scherer, Max: Ueber den Kehlkopf des Eunuchen, Berlin, 1901.

THE PATHOGENESIS OF TABES DORSALIS

WITH REMARKS ON TREATMENT OF TABES BASED ON CONSIDERATION
OF PATHOLOGY *

WALTER F. SCHALLER, M.D.

SAN FRANCISCO

Although much has been written concerning the pathology of tabes, and particularly the causes underlying the degeneration of the posterior root fibers, writers are not yet in complete accord in their conception of the exact manner in which this degeneration takes place. Certain advances in our knowledge of this disease would warrant a reopening of the question. The importance of considering the disease as an active syphilitic one, the refinements of diagnosis by examination of the cerebrospinal fluid and the propriety of certain methods of local intraspinal medication would stimulate an inquiry into a more exact knowledge of the manner in which the spirocheta ultimately, and after a considerable lapse of time as a rule, causes a degeneration of the nervous parenchyma.

In 1917, I¹ published an article on the "Early Diagnosis of Tabes," and stated among other conclusions that: "In tabes the syphilitic posterior leptomeningitis of the spinal cord (and probably also of the radicular nerve) is in etiologic relationship to the degeneration of the posterior columns of the cord. Every case of syphilitic posterior leptomeningitis and consequent multiple symmetrical radiculitis is a case of potential tabes." These conclusions were based in part on a study of the necropsy findings in a number of cases of tabes dorsalis, which are further reviewed in tabulated form in this article. Before these cases are analyzed, and other considerations bearing on this subject are dealt with in more or less detail it would seem desirable to review the literature on the question of the pathogenesis of tabes.

THEORIES OF TABES

Of these we may mention the older theories of primary gliosis, of vascular and of neuritic origin, the toxic theory first advanced by Strumpell (1882), the ganglionic theory of Oppenheim, the lymphatic theory of Marie-Guillian, the exhaustion theory of Edinger, the theories of a meningeal cause of the disease advanced by Obersteiner and

* From the Neurological Clinic, Leland Stanford Junior University School of Medicine.

1. Schaller, W. F.: Early Diagnosis of Tabes Dorsalis, J. A. M. A. 68:190 (Jan. 20) 1917.

Redlich, and by Nageotte, and recently the hypothesis of Orr and Rows of an ascending perineural infection. Of all these theories the meningeal theories and toxic theory occupy the foreground of attention.

It is now twenty-five years since the classic studies of Obersteiner and Redlich² and of Nageotte³ first appeared. The publication of Obersteiner and Redlich precedes that of Nageotte by a short interval only. It may be stated at once that these two theories have much in common and are in fact, basically the same. Obersteiner states Lange was the first to affirm that spinal meningitis was the primary lesion of tabes. He asserts that the theory of Nageotte differs from his own only in that the posterior roots are affected in a different location: Obersteiner and Redlich hold that the posterior roots are compressed in their path through the pial ring formed by the spinal pia mater, and that this compression is due in part to an inflammation or shrinking of the meningeal covering and in part to pressure from sclerosed arterial vessels. That the retraction of the pia is always due to a meningitis is not asserted, as the assumption of a constant pial inflammation appeared to be the chief objection to this theory. These authors believe that this process may take place on an anatomic individual basis. They contend that the posterior root fibers show a more intense degeneration in their intramedullary course than in their extramedullary course.

Nageotte believes that posterior column degeneration is due to an inflammatory process of the radicular nerve ("nerf radiculaire") involving endoneurium as well as perineurium and taking the form of a transverse neuritis, starting as an inflammatory process of the meninges in this locality. The radicular nerve includes both the sensory and motor roots, and extends mesially from the spinal ganglion to the beginning of the dura and arachnoidal envelop, and is in very intimate relation with it. The more resistant motor fibers escape, the sensory do not. This area of the radicular nerve is also considered to be a very important avenue of communication between the cerebrospinal fluid and the perineural lymphatic spaces.

Soon after the above theories were advanced, Philippe⁴ in France (1897), and Redlich⁵ in Germany (1897) published comprehensive

2. Obersteiner and Redlich: Ueber Wesen und Pathogenese der tabischen Hinterstrangs Degeneration, Obersteiner's Arbeiten, 1894; Abstr. Neurol. Centralbl. 13:454, 1894.

3. Nageotte, J.: Bulletins de la Société Anatomique de Paris, 8: (5 série) 808, 1894.

4. Philippe, C.: Le Tabes Dorsalis, Bailliére et Fils., Paris, 1897.

5. Redlich, E.: Die Pathologie der tabischen Hinterstrangserkrankung. Gustav Fisher, Jena, 1897.

monographs on the pathology of tabes. A toxic element acting on the intramedullary portion of the posterior roots is mentioned by Redlich as a probable factor, and he also favors the hypothesis of Edinger. It thusly appears from this later publication of Redlich that he had modified his previous views to an extent. He also states that even mild forms of meningitis cannot always be demonstrated in tabes, although the meninges cannot be said to be entirely free from a slight "thickening" without particular significance.

Philippe also states that the posterior meningitis is too inconstant and too out of proportion to explain the tabetic degeneration as being an initial interstitial process. He quotes a case previously reported by himself, one of syringomyelia, in which although the meningeal lesions were extremely pronounced, they did not occasion a degeneration of the roots which traversed them. He concludes that the degeneration is primarily a parenchymatous one which causes a degeneration of fibers without first affecting the cells of origin.

At this period Spiller⁶ made the important observation that tabes is to be considered rather as a cerebrospinal disease. In a later paper this writer⁷ discusses the pathology of tabetic ocular palsy. In reference to cerebrospinal syphilis he states that in his experiences round cell infiltration, lymphocytic infiltration of the pia, is the most characteristic lesion of cerebrospinal syphilis, and that no acute manifestation of syphilis of the cerebrospinal axis exists without it. He reports a case of complete bilateral ophthalmoplegia in a tabetic and from a study of the abducens nerves found evidence that the lesion was peripheral, that is, in the nerve itself. This would be opposed to the prevailing idea of the pathology of the ocular palsies of tabes and of brain syphilis in which in tabes the ocular paresis is due primarily to nuclear involvement, whereas in cerebrospinal syphilis it is due primarily to nerve involvement.

Derjerine,⁸ in his book on "Disease of the Spinal Cord," in reviewing the different theories, believes that neither the posterior meningitis or radicular meningitis can explain, on an exclusively anatomic basis, the degeneration of the posterior roots. He, however, admits that the diffuse meningitis which exists is an expression of an intoxication or toxi-infection of the sub-arachnoid space, and in this manner serves to elucidate the pathogenesis of tabes. That tabes is due to a

6. Spiller, W. G.: The Pathology of Tabes Dorsalis, *Int. Med. Mag.* 5: No. 5, 1897.

7. Spiller, W. G.: Pathology of Tabetic Ocular Palsy, etc., *J. Nerv. & Ment. Dis.* 42:15, 1915.

8. Derjerine and Thomas: *Traité des Maladies de la Moelle Epinière*, Paris. J.-B. Baillié et Fils, 1902.

primary posterior root involvement is strongly maintained by the authority. The intramedullary degeneration, the sparing of the endogenous sensory fibers, and the presence of the peculiar degeneration in early tabes in Burdach's column first described by Pierret (1877) are all in favor of this manner of viewing the problem. Derjerine compares the *bandelette externe* of Pierret with its central extension in Goll's column forming a figure likened to an M, to the middle radicular zone of Flechsig; the degeneration is therefore systematized and contains medium and short fibers of the posterior roots.

Rhein⁹ has studied the lesion of the radicular nerve as described by Nageotte, and also examined the spinal meninges in a considerable number of cases of tabes. He concludes that the radicular nerve lesion is not constant, and that meningitis may exist without causing the characteristic cord lesions in tabes. Strümpell,¹⁰ in a recent communication, still maintains that the essential cause of the posterior column degeneration is toxic, and in this view he is supported by Sepp,¹¹ who quotes Tinel on the toxic action of meningeal exudates. Karl Schaffer¹² in Lewandowsky's system describes the condition as a primary elective fiber degeneration. Other adherents to the toxic theory are Marinesco and Minea;¹³ Austregesilo.¹⁴ A considerable support to the supporters of the toxic theory has been given in the recent experiments of Spielmeyer.¹⁵ This author was struck by the similarity in symptoms between general paralysis and sleeping sickness, and conceived the idea of infecting animals with the *Trypanosoma brucei*. For this purpose he chose a degenerated race of dogs—spitz dogs and poodles. After keeping these severely infected animals alive for a period of nine or ten weeks a degeneration was found by Marchi's method in the posterior spinal roots, the spinal root of the fifth cranial nerve and in the optic nerve, the tabes being of the cervical type. No change was found in the ganglion cells, the spinal pia or the peripheral

9. Rhein, J. H. W.: Meningitis and Disease of the Radicular Nerves in Tabes Dorsalis, Univ. of Penn. Contributions, Neurology, No 5, 1909-1910.

10. Strümpell, A. v.: Pathologie und Behandlung der Tabes Dorsalis, Wien. med. Wchnschr. **61**:1214, 1911.

11. Sepp: Ueber die Pathogenese der Tabes, Deutsch. Ztschr. f. Nervenb. **52**:46, 1914.

12. Schaffer, K.: Tabes Dorsalis, Lewandowsky's System, Handbuch der Neurologie **2**:1916, Spezielle Neurologie 1.

13. Marinesco, G., and Minea, J.: Contribution a l'anatomie pathologique et a la pathogenie du tabes, J. f. Psychol. u. Neurol. **10**:182, 1907-1908.

14. Austregesilo, O.: Frühdiagnose der Tabes oligosymptomatica, Deutsch. med. Wchnschr. **39**:2396, 1913.

15. Spielmeyer, W.: Experimentelle Tabes bei Hunden (Trypanosomen-Tabes), München. med. Wchnschr. **53**:2338, 1906.



Lower dorsal region: Over a thickened pia, there is a superimposed lymphocytic meningitis. Note the perivascular cellular infiltration. Hematoxylin-Van Gieson.

nerves. The process described by Spielmeyer is an elective disease of the centripetal portion of the sensory protoneuron. This same investigator also studied experimental dourine in dogs where inflammatory meningeal processes took place, but no degenerative changes in the posterior roots. Root fiber disease in animals is therefore not dependent on infiltrative processes according to Spielmeyer.

In horses, however, in which this disease occurs, Mott¹⁶ found both meningeal changes and marked posterior column involvement. The degenerations were so marked in one case that the degenerated areas could be seen macroscopically. Mott makes mention of the similarity between this pathologic picture and that presented by tabes. Clinically, also, there are points of resemblance, such as spontaneous fractures and dislocations which often occur in horses affected with this disease.

In a Rhesus monkey which was sent to him for experimental purposes, Rothmann¹⁷ noted ataxia, diminished vision and disturbed cutaneous sensibility. After experimentation (pyramidal tract extirpation) examination of the cord showed posterior column degeneration in addition to degeneration in the pyramidal tracts. Because this degeneration was not accompanied by a pial meningitis, it was therefore considered to be primarily toxic. Schroder¹⁸ reports an affection simulating tabes in a monkey (*cercopithecus fulginosis*). The histologic picture of the cord degeneration resembled the changes of pernicious anemia in man.

Spielmeyer¹⁹ has studied cord degeneration produced by intraspinal stovain anesthesia. In a fatal human case the lesions were predominately in the cells of the anterior horns, but in experiments on dogs and monkeys this same investigator found the principal lesions in the posterior columns. In stovain tabes the extramedullary portion of the posterior roots are the ones first affected by the neurotoxic agent and the degeneration of the intramedullary portion of the roots is a consequence of the primary degeneration in the extramedullary portion. In this respect the degenerations differ from trypanosome tabes where the intramedullary portion of the root fibers are first affected, as is the case in ordinary tabes dorsalis. Therefore in stovain tabes the changes in the posterior roots are not due to a *locus minoris*

16. Mott, F. W.: Histological Observations on the Changes in the Nervous System in Trypanosome Infections, Especially Sleeping Sickness and Dourine, etc., Arch. Neurol. **3**:581, 1907.

17. Rothmann, M.: Ueber eine Tabes-Artiges Erkrankung beim Affen, Monatschr. f. Psychiat. u. Neurol. **20**:204, 1906.

18. Schroder, P.: Ueber eine Hinterstrang und Sehnervenerkrankung beim Affen, Arch. f. Psychiat. **44**:193, 1908.

19. Spielmeyer, W.: Veränderungen des Nervensystems nach Stovain Anästhesie, München. med. Wchnschr. **55**:1629, 1908.

resistentiae at the border line perforation of the pia. When the degenerations are extensive in the posterior columns other fiber systems are also involved and degenerations are noted in the periphery of the cord and in the anterior roots. The anterior horn cell degeneration in animals has never been observed in man. Spielmeyer concludes that the pathologic process is due to a direct toxic agent. Inflammatory reaction, sclerosis or hemorrhage are absent.

Mosse and Rothmann²⁰ have described cord lesions in dogs rendered anemic by subcutaneous injections of pyridoxin. The degenerated areas in the cord are not confined to the posterior columns, but occur with almost the same intensity in the lateral and anterolateral columns.

Degeneration of the posterior cord columns very similar to that occurring in tabes is described by Tuczek²¹ due to poisoning from ergot. In four necropsy cases Burdach's column was involved wholly or in part showing a symmetrical degeneration with a narrow intact strip between it and the posterior horn and the posterior commissure. According to Tuczek "ergot tabes" differ from tabes dorsalis only in the acute nature of the process. The symptomatology is also similar: absent lower tendon reflexes, Romberg, ataxia, paresthesias and pain. The permanent after-effects have been emphasized by Walker and Jahrmarker. Cases in literature are also referred to in which anatomic degenerations in the posterior columns have been demonstrated occurring more or less acutely in such conditions as scarlet fever, diphtheria, following the puerperium, and from absinthe poisoning (Tuczek).

In such chronic or subacute affections as leukemia, the metal poisonings, notably lead poisoning, chronic alcoholism and nutritional disorders such as beri beri, posterior column changes have been described, but these are either associated with, or dependent on, peripheral nerve disease, and appear to throw no light on the tabetic process. Williamson²² has studied the spinal lesions in diabetes and found degenerations in the intramedullary fibers of the posterior roots. He believes that these changes may occur without associated peripheral nerve disease, or at any rate without significant peripheral nerve disease.

The degenerations of pellagra also produce posterior column changes which were first studied by Borchard in 1864; later by Tuczek. The degenerations are of the combined system type. Neither vascular

20. Mosse, M., and Rothmann, M.: Ueber Pyridoxinvergiftungen bei Hunden, Deutsch. med. Wchnschr. **32**:134, 187, 1906.

21. Tuczek, F.: Ueber die Veränderungen im Centralnervensystem, spezielle in den Hintersträngen bei Ergotismus, Arch. f. Psychiat. **13**:99, 1882.

22. Williamson, R. T.: Disease of the Spinal Cord, Oxford Univ. Press, London, 1908, p. 371.

or meningeal changes are found. Quite recently Wilson²³ in a material of thirteen cases has made a detailed pathologic study of the degenerations and states that the cord lesions are pseudosystematized resembling combined sclerosis. The absence of any inflammatory reaction is noteworthy.

Long,²⁴ however, in this disease has dwelt on the presence of cartilaginous-like deposits in the spinal foraminae demonstrated by roentgenographs and found also in one necropsy case. He explains the spinal root degeneration by root pressure. In support of this explanation anatomic considerations would appear to have a bearing, for in the lower cervical region the spinal foraminae are relatively smaller in relation to the nerve roots which traverse them than is the case in the upper cervical or dorsal regions, and this would explain the hand atrophies. Likewise, the degenerations of S₁ and S₂ are possibly explained by pressure paralysis of these roots passing through the tortuous and flattened foraminae in these localities.

ANOTHER ASPECT OF THE PROBLEM

From the considerations of the foregoing meningeal and toxic theories and other conditions related to tabes which might throw some light on the pathogenesis, let us now turn to another aspect of the problem. It has been stated above that Spiller as far back as 1897 asserted that tabes is in reality a cerebro-spinal disease. I believe that this position has been justified by the advance in our knowledge of tabes which has come about by studies of cranial nerve lesions in this affection. Spiller's work on tabetic ocular palsy has been mentioned. Vincent,²⁵ in his Paris thesis, studied the degenerations of the third, ninth, eleventh and twelfth cranial nerves in tabes. He found, as did Nageotte in the spinal roots, a meningo-radiculitis where the cranial nerves passed through the dura and arachnoid coverings. From a careful study by serial sections of the nerves in this locality he concluded that the inflammatory process was intense enough to explain the cranial nerve degenerations.

In early syphilis, diminution of hearing has been explained by the presence of a specific leptomeningitis and consequent trochlear nerve involvement affecting the eighth nerve by Knick and Zaloziecki,²⁶ and

23. Wilson, S. A. K.: Pathology of Pellagra, Proc. Roy. Soc. Med., London 7:31, Neurol Sec., 1914.

24. Long, J. D.: Quoted by Niles, Pellagra, Ed. 2, W. B. Saunders Co., p. 159, 1916.

25. Vincent, C.: Des meningites chroniques syphilitiques, Thèse de Paris, Paris, G. Steinheil, 1910.

26. Knick, H., and Zaloziecki, A.: Ueber Acusticuserkrankung im Frühstadium der Lues, Berl. klin. Wchnschr. 49:639, 1912.

by Ellis and Swift.²⁷ Similarly the characteristic bilateral facial palsy has been explained due to early meningeal syphilitic involvement by a number of recent observers. Leri²⁸ has expressed the opinion that the optic atrophy in tabes is due to an interstitial process of the optic nerve itself due to syphilitic meningitis and syphilitic vascular disease. Schlagenhauser,²⁹ in a study of the course of the optic nerve fibers in a case of tabetic optic atrophy, found lesions of the optic nerve trunk in the passage through the optic foraminae, and because of the complicated nature of the disease process regarded it as due to a periostitis syphilitica or pachymeningitis.

OPTIC ATROPHY

The existence of a tabetic primary optic atrophy has also of late been seriously questioned by Stargardt³⁰ in a rather convincing study in the Kiel clinic. This study consisted of an examination of the optic nerves and retina in twenty-four cases of tabes, general paralysis, and tabo-paralysis, and nine other normal cases for control. By selected staining methods and particularly by early and suitable fixation of the retina this investigator has come to the conclusion that the optic atrophy in the foregoing disease is not due to a primary degenerative toxic process in the retina as has been assumed, but that it is due to an exudative process in the optic nerve itself chiefly in the bony canal, the intracranial portion of the nerve and the chiasma. Characteristic changes previously described in the retina are interpreted by Stargardt as due to postmortem changes from delayed fixation. He is very emphatic on the basis of his histopathologic studies that the primary lesion is in the optic nerve and not in the retina. The following pathologic changes were noted:

1. Changes described as exudative processes consisting of the presence of plasma cells and lymphocytes in pia and septum of optic nerve and in the perivascular lymph spaces. The changes are described as "infiltrative."

2. The presence of vascular changes such as described by Alzheimer (progressive form) in the localities affected by exudative

27. Ellis, A. W. M., and Swift, H. F.: Involvement of the Eighth Nerve in Syphilis of the Central Nervous System, *J. A. M. A.* **64**:1471 (May 1) 1915.

28. Leri, A.: Etude du nerf optique dans l'amaurose tabétique, *Nouv. iconog. de la Salpêtrière* **17**:358, 1904.

29. Schlagenhauser: Anatomische Beiträge Zum Faserverlauf in den Sehnervenbahnen und Beitrag zur tabischen Sehnervenatrophie. *Arbeiten aus dem Institut, für Anatomie und Physiologie des Centralnervensystems*, No. 5, 1897; *Abstr. Centralbl. f. Nerven- u. Psychiat.* **8**:564 (Neu Folge) 1897.

30. Stargardt: Ueber die Ursachen des Sehnervenschwundes bei der Tabes und der Progressive Paralyse, *Arch. f. Psychiat.* **51**:711, 1913.

process in which there is a proliferation of the endothelium and new formation of elastic membrane and increase in vessels.

3. Presence of *Abraumzellen* containing fat.

4. Increase in neuroglia.

5. Degenerative processes in axis cylinder and myelin sheath. No difference in time or extent of the degeneration could be made in the distal or proximal end of the orbital optic nerve and no conclusion, therefore, arrived at in determining an ascending or descending degeneration.

The changes in the retina are in general compared to those occasioned by pressure from a sclerotic internal carotid artery and also following experimental cutting of the optic nerve. The picture is different from that seen in ordinary toxic degenerations from quinin, felix-mas and atoxyl. Changes in the retina are found only when unmistakable changes in the nerve itself can be demonstrated; but with an intact retina early changes in the nerve may be shown. Schoenberg³¹ accepts Stargårdt's conclusions. In a comprehensive article dealing with the later investigations of the circulation of the cerebrospinal fluid and dye experiments, he supports the intraventricular or cranial subarachnoid route for treatment of optic nerve atrophy on the basis of a primary syphilitic process in the meninges.

INFLAMMATORY MENINGEAL REACTIONS

We now come to the question of inflammatory meningeal reactions in tabes. Spiller's position has already been stated. Bresowsky³² has found lymphocytic infiltration of the pia present in all of forty cases examined. This investigator working in Obersteiner's clinic, the seat of so much research on the pathology of tabes, believes that the thickening of the meninges is of distinctly inflammatory character and that its probable origin is from the blood vessels. The thickening pia may be observed in layers. This meningitis occurs undoubtedly in early tabes. The rôle of this meningeal inflammation in the pathogenesis of tabes is that of a toxic agent acting on the posterior roots in Obersteiner's area. He does not believe that pressure or sclerotic shrinking can explain the degeneration alone. Schroder³³ has found lymphocytic infiltration of the pia of inflammatory nature constantly present in five cases of tabes. This process was not limited to the pos-

31. Schoenberg, M. J.: Intracranial Treatment of Syphilitic and Parasymphilitic Nerve Affections, *J. A. M. A.* **66**:2054 (June 24) 1916.

32. Bresowsky, M.: Ueber die Veränderungen der Meningen bei Tabes und ihre pathogenetische Bedeutung, *Arb. a. d. Neurol. Instit. Wien.*, **20**:1, 1912-1913.

33. Schroder, P.: Ein Beitrag zur Histopathologie der Tabes Dorsalis. *Centralbl. f. Nerven- u. Psychiat.* **29**:585, 1906.

terior aspect of the cord but was also seen in the anterior septum. This investigator suggests that the diffuseness of the inflammation may explain the degenerations of the anterior and lateral columns when this occurs. Astwazaturow³⁴ reports a case of gastric crisis which he believes due to an underlying specific syphilitic meningitis involving the posterior spinal roots. His case did not show typical tabetic degenerations, and there was also evidence of a meningomyelitis present. The case might be regarded rather as one of pseudo-tabes. Schaffer, although an exponent of the toxic theory, states that in a number of cases of lumbar tabes he has observed also isolated degeneration of the cervical roots and corresponding degenerations in the *bandelette externe*. Starr (personal communication) relates a case in which this degeneration was found on one side of the cord only. Hassin,³⁵ in America, favors the meningeal theory, as does Williams.³⁶

ANOTHER GROUP OF CASES

There are a group of cases classified as pseudo-tabes syphilitica some with pronounced meningeal involvement. These types are aptly defined by Collins,³⁷ who has written on this subject as those in which clinically there is a picture of tabes and pathologically characteristic lesions of syphilis in the meninges or cord or both, but in which the distinctive lesions of tabes are not necessarily present.

Panegrossi³⁸ reports a case clinically diagnosed as tabes which revealed in the postmortem examination a striking accompanying pial meningitis in addition to the characteristic pathology of tabes (degeneration of the posterior root fibers in their extramedullary and intramedullary course, degeneration of the fibers in the Lissauer zone). The author raises the question whether in this case the cord changes may not be considered to be secondary to the spinal meningitis and refers to a number of reported cases in the literature referred to as cases of pseudo-tabes syphilitica: (Bibliography) Guiffre and Mitro, Lamy, Maplain, Fournier and Dieulafoy, Cardarelli, Garbini, Eisenlohr, Nonne, Oppenheim, Rump, Collins, Brash, Gaykiewicz and Schwartz.

34. Astwazaturow, M.: Ueber Beziehungen zwischen Tabes und Leptomeningitis, *Deutsch. med. Wchnschr.* **37**:64, 1911.

35. Hassin, G. B.: Chicago Neurological Society, Meeting of Jan. 21, 1915. reported in *J. Nerv. & Ment. Dis.* **42**:699, 1915.

36. Williams, T.: The Pathogenesis of Tabes Dorsalis, *Am. J. M. Sc.* **136**:206, 1908.

37. Collins, J.: Syphilitic Pseudotabes, etc., *New York M. J.* **77**:533, 581, 1903.

38. Panegrossi, G.: Beitrag zum Studium der vom chronischen spinal Meningitis begleiteten Tabes, *Monatschr. f. Psychiat. u. Neurol.* **23**:290, 1908.

On the basis of an anatomic-clinical study, however, in his case he has determined it to be one of cervical dorsal tabes combined with chronic spinal leptomeningitis.

Some mention should be made of combined tabes and amyotrophic tabes in considering the genesis of this affection. The underlying pathology of these complicating or associated conditions is as indefinite in the literature as is the case in the uncomplicated forms of tabes. The diffuse meningitis found by Schröder may be considered as a cause in this connection. Likewise, amyotrophic tabes may be explained by anterior root involvement and lower motor neuron disease. Wilson,³⁹ however, in an anatomic-clinical study of two cases is inclined to favor the toxic hypothesis in amyotrophic tabes, although there was a spinal meningitis present in both cases. It is, however, proper to here express the opinion of Derjerine in this regard. In discussing the rôle of meningitis in tabes he states: "Other factors besides meningitis are necessary to produce tabes. The best proof of this is that in individuals affected with syphilis paraplegia in consequence of meningo-myelitis, tabes is an exceedingly rare complication."

REPORTS OF SIXTEEN NECROPSIES

I have charted the necropsy records of sixteen cases of tabes dorsalis with this pathologic diagnosis. These cases were examined between the years 1898-1916 in the pathological department of the Stanford Medical School. Examination of the cerebrospinal fluid when made, the anatomic diagnosis, macroscopic and microscopic examinations of the spinal cord and meninges are noted. Abnormal changes in the meninges are printed in black face type. Thickening or cellular infiltration of the spinal meninges most marked in the posterior portion of the cord occurs in most cases; in fact, if we accept Case 1, in which no record of a microscopic examination is made, and Case 6, which is a classic description of combined sclerosis and not of tabes, one or the other of these processes is a constant finding. An instructive instance is that of Case 13 in which, with advanced atrophy in the posterior columns associated with marked fibrous thickening of the dorsal pia and adhesions between it and the dura the cerebrospinal fluid tests were entirely normal. No mention is made of a lymphocytic infiltration in this case, the assumption being that it did not exist, and the negative cerebrospinal fluid findings are thusly explained. Such a condition of the cerebrospinal fluid in cases of undoubted tabes has been reported among others by Purves Stewart,

39. Wilson, S. A. K.: The Pathology of Two Cases of Tabetic Amyotrophy. *Rev. Neurol. and Psychiat.* 9:401, 1911.

TABES DORSALIS—SIXTEEN NECROPSIES

Case No.	Pathologic No.	Initials, Age, Sex	Clinical Diagnosis	Necropsy Date	Examination of Cerebro-spinal Fluid	Anatomic Diagnosis	Examination of Spinal Cord and Meninges	
							Macroscopic	Microscopic
1	I 34	L. Y., male	No record	9/24/48	No record	Tabes dorsalis; atheroma; bronchopneumonia	Anemia of pia mater; posterior columns grayish white	No record
2	VI 33	C. J., middle aged male	No record	11/29/02	No record	Tabes dorsalis; chronic spinal meningitis of posterior surface of cord with adhesions between dura and pia; degeneration of posterior white columns; aneurysm of ascending aorta with erosion of sternum, perforation into pericardium; hyperemia and edema of lungs; mucous bronchitis; hypertrophy of thyroid; chronic gastritis	Pia mater normal on anterior surface; pia mater on posterior surface in lumbar and thoracic region thickened, adhesions between dura and pia; discoloration in column of Goll in upper dorsal and cervical regions on cut section	Thickening and cellular infiltration on pia; marked atrophy in median posterior white columns
3	VI 46	Middle aged male	No record	1/16/03	No record	Tabes dorsalis; gray degeneration of posterior white columns of spinal cord; slight chronic meningitis spinalis and cerebellis; acute carbolic acid poisoning; edema glottidis	Slight chronic meningitis; gray degeneration of posterior white columns	No record
4	IX 70	C. F., elderly male	No record	3/9/06	No record	Tabes dorsalis; chronic meningitis of cord, probably syphilitic; chronic cystitis; prostatic prostatic arteriosclerosis of aorta; bronchopneumonia	Pia normal on anterior surface of cord; on posterior surface hyperemic, edematous and thickened; adhesions between dura and pia throughout length of cord; no visible lesions on cross section	Pia of posterior part of cord shows marked fibrous thickening with regular cellular infiltration; slight degeneration of most peripheral fibers in posterior columns
5	X 23	Male	Syphilis	12/25/06	No record	Tabes dorsalis; sclerosis of posterior white columns; meningoradiculitis and atrophy of cerebellum; mitral stenosis, hypertrophy of right side of heart; cyanotic atrophy of liver; bronchopneumonia; cystitis and pyelitis; atrophy of left kidney	Marked gray discoloration of posterior columns, no marked thickening of pia over arachnoid; hyperemia of pia with adhesions between dura and pia in cervical cord	Moderate fibrous thickening of pia and some cellular infiltration; very many amyaceous bodies in diseased parts of cord; marked sclerosis of posterior white columns
6	XI 30	S. A., 51, female	No record	2/7/08	No record	Tabes dorsalis; recent degeneration of motor tract; embolism, main right branch of pulmonary artery; fatty heart; thrombosis of both femoral veins; brown atrophy of heart and liver; chronic gastritis; adhesions in left half of abdominal cavity and pleura	Spinal canal and cord macroscopically normal	No meningitis; degeneration of the median portion of posterior white columns, also of lateral columns; degeneration of crossed and uncrossed pyramidal tracts with vacuolation
7	XV 63	R. E., 60, male	Locomotor ataxia, perforating ulcer	1/23/12	No record	Tabes dorsalis; perforating ulcer of feet; chronic suppurative cystitis and pyelitis; emphysema; adhesive pleurisy; fibrous pericarditis; arteriosclerotic kidneys; parenchymatous degeneration of liver and kidneys	Grayish thickening of pia on posterior surface of cord; cut section of cord shows grayish discoloration of median columns in cervical region and beneath thickened pia in lower dorsal region	Marked fibrous thickening of pia on all sides of cord; marked degeneration of posterior white columns
8	XV 74	K. W. P., 54, male	Chronic gastritis, terminal pneumonia	2/24/12	No record	Tabes dorsalis; chronic posterior meningoradiculitis; edema of dura mater; purulent cystitis; chronic bronchitis; emphysema; arteriosclerosis of aorta	Pia under shows a whitish, thickening and is adherent to pia mater on surface of posterior white columns	Marked fibrous thickening of pia over posterior white columns; marked degeneration of posterior white columns

9	XVI 136	F. P., 56, male	Tabes dorsalis	1/ 6/13	No record	Tabes dorsalis: atheroma of aorta severe, probably syphilitic; arterio-sclerotic scars in right kid- ney; pseudomembranous cystitis; prostatic abscesses; pyelone- phritis; adhesions in both pleural cavities; hypostatic pneumonia Tabes dorsalis; tuberculosis of lungs (chronic), kidneys, intestines and left hip joint; chronic sal- pingitis; colitis acute	Pia mater over posterior surface of cord shows a white thickening from lower end to cervical region; cut section of cord shows a very marked gray discoloration of pos- terior columns throughout cord	Thickened and infiltrated meninges around whole of cord most marked in posterior and lateral aspects; marked degeneration of posterior columns
10	XVII 45	R. L., 37, female	Tabes (?), tuberculosis of lungs and left hip, tuberculous meningitis	11/14/13	Five leuko- cytes per c.m.m.	Tabes dorsalis; bronchiectasis chronic; bronchopneumonia; pye- litis; cystitis; abscess of kidney multiple	Pia mater on anterior surface of cord normal; posterior surface shows whitish thickening, and some hyperemia over lower por- tion of cord; marked degenera- tions of posterior columns throughout cord	Some cellular infiltration and mod- erate fibrous thickening of pia espe- cially on posterior aspect of cord; degeneration of nerve fibers most marked in Goll's columns
11	XVII 109	D. M., 49, male	Tabes dorsalis	5/25/14	No record	Tabes dorsalis; bronchiectasis chronic; bronchopneumonia; pye- litis; cystitis; abscess of kidney multiple	Cut sections of cord show distinct degenerations in posterior col- umns, most striking in cervical region, also degeneration in Clarke's columns	Thickened pia with cellular infiltra- tion over dorsal surface of cord most marked in dorsal and lum- bar region; degeneration of pos- terior columns of cord
12	XVIII 44	L. O., 44, female	Tabes dorsalis, endocarditis, cystitis, pyelitis	10/10/14	Globulin increased, leukocytes 15.4 per c.m.m., Wassermann +++	Tabes dorsalis; pelvic peritonitis acute; cystitis acute; pyelitis acute; endocarditis chronic; bron- chitis acute; bronchopneumonia	Pia mater over anterior surface of cord normal; over posterior sur- face there is an edematous thick- ening and hyperemia; cross sec- tion of cord shows a slight grayish discoloration of posterior columns in lumbar region	Marked fibrous thickening of pia with lymphocytic infiltration; ex- tensive degeneration in posterior white columns
13	XVIII 80	H. P., 56, male	No record	12/14/14	Wassermann negative, cell count and globulin not increased	Tabes dorsalis; pyelitis chronic; pyelonephritis; dysentery (?)	On dorsal surface of cord many adhesions between dura and pia; cut sections of cord show grayish discoloration of posterior columns especially in cervical region	Marked fibrous thickening of pia over posterior surface of cord; very marked atrophy in posterior white columns
14	XVIII 117	W. W. T., 45, female	Tabes dorsalis, arsenical poisoning	1/28/15	Wassermann negative, glob- ulin positive, leukocytes 11.2 per c.m.m. (Wassermann negative blood)	Tabes dorsalis; cystitis; pyelitis; pyelonephritis acute; bladder per- foration of; peritonitis acute; arsenical poisoning acute (salvar- san); colitis ulcerative	Slight adhesions between dura and cord on posterior surface in cervi- cal region; pia mater is slightly infected but not definitely thick- ened; no visible degeneration on cut surface	In lumbar region marked degenera- tion in posterior white columns, extending across from one side to the other between central canal and half way to posterior surface; slight but definite lymphocytic infiltration of spinal pia
15	XIX 86	M. J. L., 54, male	Tabes dorsalis	1/28/16	No record	Tabes dorsalis; cystitis chronic; pyelonephritis acute; ulcer of foot, perforating; syphilis of aorta; abscess of heart muscle, metastatic	Dorsal pia of cord thickened, opaque and hyperemic along entire surface; a lardaceous and hyperplastic meningitis is seen in dorsal cord; ventral aspect of cord does not appear to be in- volved; cut section of cord shows extensive degeneration of pos- terior columns	Marked fibrous thickening of pia especially on posterior aspect of cord; atrophy of nerve fibers in posterior white columns
16	XIX 141	O. L., 50, male	Tabes dorsalis	4/15/16	Wassermann positive, glob- ulin positive, leukocytes 30 per c.m.m.	Tabes dorsalis; cystitis acute; bronchopneumonia	Pia over dorsal surface of cord somewhat thickened; on cut section the dorsal columns are distinctly yellowish brown	Marked fibrous thickening of pia sur- rounding cord, most marked on pos- terior and lateral surfaces; exten- sive degeneration of posterior white columns, also degenerations in one crossed pyramidal tract and in the uncrossed pyramidal tract of the opposite side

Babinski, Ferrier and by Nonne. In the Stanford Clinic such a case is occasionally met with. But we have elsewhere maintained and still hold that a progressive tabes will at one time or another time show a cerebrospinal fluid reaction characteristic of subacute inflammatory meningitis. Andre Leri⁴⁰ has reported a case of meningomyelitis in which the meninges at different levels of the cord presented different pictures: at one level definite thickening of meninges without cellular infiltration, and at another level meningeal thickening plus cellular infiltration. Case 11 (colored insert) is interesting in this regard, a section in the lower dorsal region showing a condition in the meninges somewhat similar to the foregoing. Over an area of previously thickened membranes there is a superimposed cellular infiltration suggesting the progression of the meningeal lesions in different stages: the first stage of inflammation having subsided, there resulted a fibrous thickening, and after a certain remission a recurrence of the meningeal infiltration with characteristic fluid changes. (No record of these fluid changes in the charted case.) In Case 14 (see figure) a section at L₁ shows the degeneration described by Pierret.

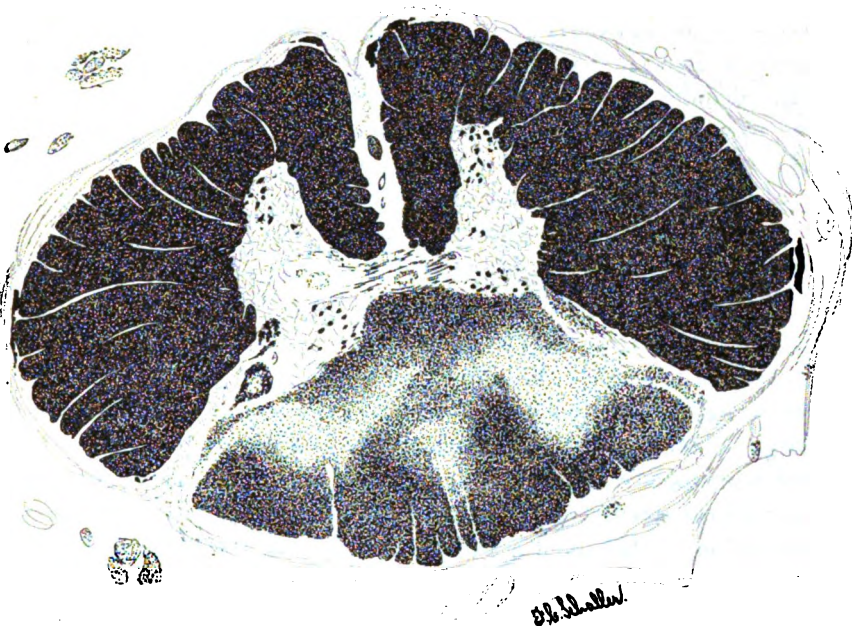
An examination of the table will show the distribution and extent of the meningeal changes. It is noteworthy that these findings were for the most part established in a general pathologic laboratory, and were noted not as a particular study of tabes, but as part of the general pathologic survey of the case. It is possible, as has been maintained by Bresowsky, that by improved staining methods, cellular infiltrations including the presence of plasma cells might be demonstrated in practically all of these cases.

Spielmeyer,⁴¹ in a recent review of articles dealing with the pathologic anatomy of tabes states that the advocates of the meningeal theory are less often heard from now than formerly. He denies that an inflammatory meningeal reaction is a constant finding in tabes. We are not able to follow Spielmeyer in all his arguments. Spielmeyer's trypanosome dogs died of a subacute general infection. Microscopic examination of the spinal cord showed some slight degeneration of the cerebellar tracts in addition to the degeneration in the posterior columns, and our impression from reading Spielmeyer's article was that even in the posterior columns the degeneration was slight. No cerebrospinal fluid examination was made, and although no meningeal

40. Leri, A.: Soc. Neurol., Paris Séance, Dec. 30, 1911, Rep. Rev. neurol **22**:785, 1911.

41. Spielmeyer, W.: Paralyse Tabes Schlafkrankheit, *Ergeb. der Neurol. u. Psychiat.* **1**:217, 1912.

inflammation was found it is not stated that this examination included an examination of the radicular nerve (Nageotte). Even in the presence of optic atrophy and fifth nerve involvement a primary toxic combined sclerosis must be considered here. It is to be regretted that the trypanosome strain which Spielmeyer used in these experiments had died out, and that we have not been able to find a record of a repetition of these experiments. In stavain tabes his finding that a direct neurotrophic action of the drug acts on the extramedullary portion of the posterior root fibers would not appear to support the theory that a syphilitic toxin would act differently, that is, on the intramedullary portion of these fibers and spare other intramedullary fiber systems.



Bandelette of Pierret. L₁—Weigert stain.

The tabulated list presented in this study shows the constancy of meningeal changes in tabes, as has been noted particularly of late in the special investigations above mentioned (Spiller, Bresowsky, Schroder). Assuming that the cerebrospinal fluid reactions are due to the presence of a subacute syphilitic meningitis we would emphasize the importance of fluid tests in the routine examination of a case of tabes, and would even go so far as to say that the information obtained from a characteristic positive fluid in a progressive tabes is one of the greatest aids to diagnosis that we possess in this affection. Such

being the case the pathologic condition which it evidences in the meninges would give this condition the dignity of a basic pathologic condition rather than a complication which the supporters of the toxic and other theories would have us believe is the case.

Not alone is the pial and arachnoid meningitis a *basic* pathologic condition, but it is in all probability a *primary* one in the affection we are considering. Since Ravaut, in 1903, called attention to the involvement of the nervous system (alterations in the cerebrospinal fluid) without nervous symptoms in cases of general infection of syphilis his findings have been corroborated by a number of subsequent investigators. Nichols,⁴² for example, has dwelt on the important fact that the cerebrospinal meninges may be invaded in the primary and secondary stages, and he has elsewhere expressed the opinion that this local infection is not temporary and comparable to the skin rash, but persists to later be associated with those pathologic conditions which underlie certain definite types of nervous syphilis, as for example, tabes. Quite recently Fildes, Parnell and Maitland⁴³ studied a large number (624) of unselected cases of syphilis and found pleocytosis in 18 per cent of these. The occurrence of a positive Wassermann reaction and the demonstration of the *Spirocheta pallida* established the syphilitic nature of the process. In 80 per cent. of these cases which presented abnormal fluids, there were no clinical symptoms or signs of nervous disease.

MENINGEAL THEORY

In support of the meningeal theory of tabes we may mention the findings of Mott in dourine, of Long in pellagra, and especially the recent pathologic studies of optic nerve degenerations in tabes which appear almost conclusive. We have been accustomed to typify a toxic degeneration of the spinal cord by the subacute combined degenerations observed so often in association with severe anemias. But here surely the picture is quite different, there being no inflammation present and the degeneration is not limited to one system. The degenerations found by Rothmann and by Schroder in monkeys may belong to this type.

The ergot degeneration found by Tuzek appears to be similar to that observed in tabes, but in the absence of modern staining methods we are not prepared to accept the pathologic findings as conclusive.

42. Nichols, H. J.: Observations on the Pathology of Syphilis, J. A. M. A. 63:466 (Aug. 8) 1914.

43. Fildes, P., Parnell, R. J. B., and Maitland, H. B.: Unsuspected Involvement of the Central Nervous System in Syphilis, Arch. Neurol. and Psychiat. 1:231, 1919.

The functional behavior of the cerebrospinal fluid in which the meninges are suspected of being originally affected has been the subject of a series of studies in the Stanford Clinic. Mehrrens and West⁴⁴ have studied the absorption of the cerebrospinal fluid in tabes among other conditions by means of phenolsulphonephthalein injected into the spinal subarachnoid space and later recovered from the urine. Under normal conditions the appearance time is within ten minutes of injection, but in disease of the central nervous system, especially when the meninges are involved, this time is appreciably lengthened. In nine cases of tabes presenting both positive clinical and positive fluid tests the appearance time of the dye was thirty minutes or over, with but one exception. In five additional cases of clinical tabes with negative fluid findings throughout, including the Wassermann reaction and gold sol test, the average excretion time was forty minutes. Of these five cases, three had negative fluids when first observed, and two became negative following treatment. The importance of this test as a means of diagnosis in such cases is apparent. In the above study no conclusion was arrived at as to the location of the absorbing tissues. Recently Dandy and Blackfan,⁴⁵ and Cushing and Weed⁴⁶ have studied the question of fluid absorption. The former investigators believe that the absorption of the cerebrospinal fluid takes place as a diffuse process within the whole subarachnoid space directly into the blood by means of the capillaries. A double ligation of the spinal dura in the dorsal region prevented fluid circulation, and injection distal to the ligation showed reappearance of the dye in the blood. They reject the contention of Mott and of Goldmann that the lymphatics play any appreciable part in this absorption process. Cushing and Weed believe that the most important channels of absorption are by means of the arachnoid villi into the large cranial venous sinuses. Damaged meninges with impaired function in tabes might thusly explain delayed absorption time.

In a paper shortly to be published, Mehrrens, in the Stanford Clinic, has extended his studies of the cerebrospinal fluid to a consideration of cerebrospinal fluid pressure in those diseases in which as a result of chronic inflammatory processes the meninges show destructive changes. Not only is fluid pressure increased in cases

44. Mehrrens, H. G., and West, H. F.: Absorption of Phenolsulphonephthalein from the Subarachnoid Space in Diseases of the Central Nervous System, *Arch. Int. Med.* **20**:575, 1917.

45. Dandy, W. E., and Blackfan, K. D.: Internal Hydrocephalus, *Am. J. Dis. Child.* **8**:406, 1914.

46. Cushing and Weed: Studies on the Cerebrospinal Fluid, *J. M. Res.* **31**:1, 1914.

which show positive laboratory evidence of inflammation, but it persists in cases of tabes and cerebrospinal syphilis in which the fluid reaction has become normal following specific treatment, or was normal when first investigated, as is possible in certain stages of tabes. In this latter group of negative fluids in tabes an increased pressure of fluid from 150 to 250 mm. of water has been found in 85 per cent. of the cases. This test points to damaged meninges, and is therefore of diagnostic importance.

From the foregoing I am an adherent to the meningeal theory of tabes in the sense that the meningeal inflammation occasions in some manner the characteristic degenerations of the posterior roots and the posterior columns of the cord. The exact manner in which this takes place is still uncertain. Although the necropsy study was limited to the cord meninges, I do not wish to assert that this is the only location of such a process, for the frequency of Nageotte's meningo-myelitis has been proved by a number of different investigators. I believe that the slight thickening of the meninges noted by the earlier writers is always inflammatory in origin. And although in comparison with other disease of apparently more severe meningeal lesions with intact root fibers, we must not lose sight of the fact that tabes runs an exceedingly chronic course, punctuated with remissions and exacerbations. I have reported a case of tabes first in which the incubation period was forty-four years. How, then, may these meningeal lesions act? We may mention the following possibilities:

1. *Mechanically:* (a) By fibrous construction of the dorsal roots in their perforation of the spinal pia at Obersteiner's area. (b) By root pressure from increased cerebrospinal fluid pressure in this same locality.

2. *Inflammatory:* By direct extension of meningeal inflammation causing a meningo-radiculitis as in Nageotte's area.

3. *Toxic:* By toxic products engendered by the meningeal inflammation in the subarachnoid space, and affecting the dorsal roots.

THERAPEUTIC INDICATIONS

In the Stanford Clinic we have based certain indications of therapy in tabes on the above conception of a primary inflammatory meningitis as being the principal pathogenetic factor in tabes. So long as increased cell count and protein content exist in the fluid the process is active and must be treated. If the ordinary intravenous arsphenamin and ordinary mercurial treatments are powerless to modify these abnormal states then the intraspinal methods of therapy are indicated. Exceptionally, when special cranial complications arise, intracranial methods may be likewise indicated. In not a small

experience, extending now over a period of a number of years, we believe that the fluid may be cleared in tabes by intraspinal therapy, when previous intensive intravenous treatment fails to produce this result. The Wassermann reaction, increased pressure of the fluid and delayed absorption time are more difficult to modify, not being dependent of active meningeal processes. In the case of a negative fluid indicating an arrest of meningeal inflammation we believe that intraspinal treatment is contraindicated.

CONCLUSIONS

1. Tabes is due to a degeneration of the posterior spinal roots.
2. Subacute syphilitic inflammatory changes in the subarachnoid space (posterior leptomeningitis, meningeal and neural involvement of radicular nerve) are in etiologic relationship with the degeneration of the posterior roots. Likewise similar processes explain the cranial nerve involvement in tabes.
3. The manner in which this subacute inflammatory meningitis produces root degeneration is as yet uncertain: it may act by direct extension of the meningeal lesions to the nerve roots causing a meningo-radiculitis; or by pressure constriction from sclerosed meninges; by toxic products engendered by this inflammation; or even by increase of fluid pressure as is the case in posterior spinal root degeneration in brain tumor. These causes may act together or independently.
4. This inflammation, which is constant in tabes to a greater or lesser degree, is evidenced by characteristic cerebrospinal fluid changes at one time or another in every case of tabes.
5. Specific therapy in tabes should have for its object the reappearance of normal fluid reactions. Intraspinal therapy may be necessary to attain this object.
6. Conversely intraspinal treatment is contraindicated when the fluid shows no inflammatory reactions.

SOME ADVANCES IN THE SURGICAL TREATMENT OF INJURIES OF THE NERVOUS SYSTEM

A CRITICAL REVIEW

CHARLES A. ELSBERG, M.D.

NEW YORK

"He who desires to learn the practice of surgery must go to war." Thus spoke the "father" of medicine more than 2,000 years ago, and his statement is, in a sense, applicable to the surgical experiences of the world struggle that has just ended. The war was fought not by armies but by nations, and every element in the communities was mobilized for war purposes. The medical and surgical treatment of the enormous number of wounded was a problem not only for the military surgeon in the front, base and home hospitals, but also for the scientific laboratory investigator at home.

To give, therefore, a brief account of the advances during the war, in the surgical treatment of injuries of the nervous system, demands a consideration not only of the actual improvements in operative methods, but also of the laboratory and clinical investigations of war problems which have made these surgical advances possible.

The following summary deals only with the real progress that has been made and is therefore not a review of everything that has been written on the subject. No consideration will be given to details of surgical technic which have no interest for the neurologist, and no references have been made to publications in which no new and useful methods have been described. A large part of this review is a summary of facts derived from personal communications made to the writer together with a statement of his own experiences in the surgical treatment of war injuries of the central and peripheral nervous systems in home hospitals.

I. INJURIES TO THE SKULL, WITH REFERENCE TO THE CRANIAL CONTENTS

The problems of intracranial surgery for injuries of the brain have been mainly those that have to do with penetrating wounds of the skull, and the surgical treatment of these wounds has been in the main a question of prevention of infection and meningitis. Fractures of the skull, without injury to the scalp or dura, with which were associated intracranial lesions, did not present any problems which had not been met with in the surgery of civil life, and no new indications or methods of treatment have been evolved.

In the beginning of the war it was the common practice of military surgeons to open wounds of the skull widely and to drain them extensively. By free drainage of the wound infection was to be prevented. Very soon, however, the method of treatment was found to be unsatisfactory. Free drainage did not, in many instances, prevent infection; secondary suppuration occurred and large brain hernias, with all their dangers, resulted. The attempt was then made to apply the principles of "debridement" to skull and brain wounds, as this method of treatment had given such good results in wounds of other parts of the body.

The viewpoint which led to this change in the surgical methods was the following: In every patient who has sustained a wound of the skull and brain, a certain amount of infectious material has been implanted in the wound. If the patient is seen early enough (within from twenty-four to forty-eight hours) the removal of the tissues into which infectious material has been implanted should remove the danger of infection. If infection has already occurred, a wide extirpation ("debridement") of the infected tissue might still prevent the spread of the infection. In either case the surgeon should, as far as possible, operate in healthy tissues. This was possible as far as scalp, bone or dura were concerned. Obviously, however, wide excision of contused or pulpified brain tissue was impossible, and all that could be done was to remove, by irrigation and other mechanical means, whatever tissue was softened and destroyed. The best results were obtained by the method of "excision en bloc." The wound in the scalp was excised, the operator keeping in healthy tissue well away from the injured area. In a similar way a piece of bone was removed in one piece and an area of dura around the point of injury was excised. The softened brain tissue was then carefully washed away by a stream of saline solution. Cushing¹ inserted into the track in the brain a flexible soft rubber catheter which was used both for palpation and search for foreign bodies and for suction purposes. By attaching to the end of the catheter a Carrel-Gentile glass syringe with its rubber bulb, softened brain tissue, fragments of bone and small foreign bodies could be sucked up into the catheter. By gentle irrigation through the catheter additional destroyed tissue and bone fragments could be removed. Larger foreign bodies, if they lay in the track, could be palpated and removed with delicate forceps. Only those that are easily accessible should be extracted; those whose removal would surely increase the damage already done, should be allowed to remain. Other surgeons, however, did not use the catheter method, but

1. Cushing, Harvey: Notes on Penetrating Wounds of the Brain 1:221 (Feb. 23) 1918.

mechanically removed the cerebral debris.² Cushing injected into the track a small quantity of dichloramin-T in eucalyptus oil. The dura was then closed by suture, a plastic operation, or by fascial transplantation, and the wound in the scalp closed without drainage—also by a plastic operation if necessary.

From the time that this technic was introduced (De Martel, Cushing, Gray) there was a steady fall in the mortality of cranial operations, meningitis became more rare and hernia of the brain unusual. Cushing states that before this method of treatment was introduced, at least 70 per cent. of the patients operated on succumbed at the forward or base hospitals, and his contention is supported by the early statistics.³ On the other hand, later statistics show a mortality of only 20 to 30 per cent. (Cushing, 28.8 per cent.).

The majority of the wounds which could be treated by the method above outlined, healed by primary union. When this "excision en bloc" was thoroughly carried out, it was found that, if necessary, an uninjured dura could be incised with comparative safety. Extensive shell wounds with great loss of substance, however, had still to be treated by the open method, and in these the mortality from infection and meningitis remained high. The majority of these cases, however, were, on account of the extensive injury to the brain, hopeless from the very beginning.

To a very great extent in the operations in the hospitals of the American Expeditionary Forces, and to some extent in the hospitals of the English and French, local anesthesia was substituted for general anesthesia in many cranial operations. The most extensive cranial operations were performed under local anesthesia with novocain. The violent respiratory efforts made by a patient who is being anesthetized by ether are accompanied by sudden increases and decreases of intracranial pressure, and these are very apt to diffuse disorganized and softened brain tissue over the meninges, and thus spread infectious material. Cushing claims that the use of local anesthesia in operations for the cranio-cerebral wounds of warfare, has distinctly contributed to improved results.⁴

2. De Martel: In Chatelon and De Martel, *Blessures du Crâne et du Cerveau*, Masson et Cie, 1917; Gray: *Brit. M. J.*, 1916; Williams and Albert: *Bull. et Mém. de la Soc. de Chir. de Paris* 44:7 and 36, 1918.

3. Abadie: *Presse méd.*, 1916, 56 per cent.; Cuneo: *Presse Méd.*, 1916, 60 per cent.; Sencert: *Lyon Chir.*, 1916, 63.5 per cent.; Moulouguet et Legrain: *Presse Méd.*, 1918, 62 per cent.

4. Cushing: *Loc. cit.*; De Martel: *Bull. et mém. Soc. de Chir. de Paris*, 44:1364, 1918.

Perhaps the most important laboratory work in connection with the subject of meningitis, is that of Weed,⁵ in which he showed that, in animals who had received intravenously an otherwise non-toxic dose of bacteria, the withdrawal of cerebrospinal fluid by lumbar puncture was very apt to be followed by meningitis on account of changes in the permeability of the choroid plexuses. While there is, as yet, no evidence that the results obtained by animal experiments are applicable to man, the evidence is sufficient to make lumbar puncture in threatened meningitis or in patients who have sustained a cerebral injury and in whom a meningeal infection is possible, inadvisable unless very specially indicated.

The experiences of the Medical Corps of the American Army are too recent to permit one to say much regarding the treatment of the secondary and late complications of brain wounds. The best résumé of the subject from other sources is that of Gordon Holmes,⁶ based on the examination of 2,357 patients, of whom 526 were personally observed.

Secondary abscesses of the brain are most apt to occur between three and six months after the wound, but they may occur at any time in patients with an unhealed wound or a cerebral hernia. They may occur under a necrosed fragment of the skull, or deep in the brain around a fragment of indriven bone or a foreign body, or at some distant region of the brain not affected by the primary wound. As is well known from experiences in civil life, these abscesses are very apt to occur after wounds or infections in the orbit or ethmoid sinuses. Of 37 cases that were operated on, 28 terminated fatally. The best treatment consisted in puncture or evacuation through a small incision and drainage. Gordon Holmes states that the results were not satisfactory. (In the few cases operated on personally by the reviewer, the results have been excellent.) It is my opinion that the percentage of good results will vary with the surgical method adopted and especially with the care in the after-treatment of the patients. It is poor practice, after a brain abscess has been drained at an operation, to remove the drainage tube at each subsequent dressing and to reinsert it. After a drainage tube is once in place and is fixed to the scalp by suture so that it cannot be disturbed, it should never be removed as long as there is any drainage at all. When the amount of drainage has become small, the tube should be shortened, but it should never be removed and replaced during the entire surgical treatment.

5. Weed, Wegeforth, Ayer and Felton: The Production of Meningitis by the Release of Cerebrospinal Fluid, *J. A. M. A.* **72**:190 (Jan. 18) 1919.

6. *Comptes Rendus de la Conférence Chirurgicale interalliée pour l'étude des plaies de guerre*, Novembre, 1917.

This I believe to be the "enacting clause" in the successful treatment of late brain abscesses.

As we have already stated, the frequency of cerebral hernia was much diminished with the improved treatment of the cranio-cerebral wounds. If a cerebral hernia persists for a very long period or develops late, an infection of the brain tissue is present in the large majority of cases. The attempt to resect the hernias was followed, as was to be expected, by disastrous results, and this method of treatment was soon discontinued. The statement that a hernia which persists more than three months or one that appears after this period of time usually means that there is an infection within the brain tissue—most often an abscess—is justified. The treatment of these late abscesses in brain hernias should not differ essentially from the treatment of late abscesses without cerebral protrusion.

We cannot leave the subject of the treatment of cranio-cerebral wounds without mentioning the fact that many excellent studies of the symptoms of brain lesions have been published, which have contributed to clarify certain clinical pictures and have hence contributed distinctly to improving the indications for operation in some intracranial injuries. Thus mention must be made of the so-called "longitudinal sinus" syndrome, that peculiar bilateral spasticity which results from compression of the longitudinal sinus by depressed bone. Then also the fact, mentioned by very many writers, that surprising improvement may occur without operative interference in many apparently extensive and hopeless cerebral injuries.

From the standpoint of fatality, it soon became evident that injuries of the transverse and lateral sinuses were far more dangerous, and the mortality with or without surgical interference far greater in these than in injuries of the longitudinal sinus. This was well shown, for example, by the statistics of Velter;⁷ all but one of the patients with a laceration of the transverse sinus died, usually from hemorrhage; the majority of those with an injury of the longitudinal sinus—unless the injury of the brain was excessive—recovered.

Lack of space prevents the mention of many excellent clinical papers.

II. INJURIES TO THE SPINAL CORD

The subject of the surgical treatment of wounds of the spinal cord can be, unfortunately, dismissed with a few words. As was the case in the Crimean campaign, in our own Civil War, and in the Boer War, the injuries of the spinal cord by bullets or other missiles have been to a great extent, irremediable. As a group, spinal cord injuries

7. Velter: *Les Plaies du Crâne*, 1917.

are the most deplorable of all war injuries. While, rarely, a bullet or shrapnel ball may enter the spinal canal without injury of the cord, a complete division or transverse softening is usual. The experiences of the war have shown that the spinal dura should never be opened if it is intact, and in these cases the wound of the soft parts and the bone should be treated by "debridement" and the Carrel-Dakin method of irrigation. From the technical surgical standpoint, no advances have been made in spinal surgery as a result of the experiences of the war. On the neurological side, however, many valuable facts have been recorded. As some of these have a bearing on the indications for treatment and on prognosis, they are deserving of mention.

The reports of Head and Riddoch⁸ have once for all given the coup de grace to the so-called Bastian-Bruns law, and have definitely proved that spasticity and exaggeration of reflexes can and do frequently occur after a complete transverse cord lesion. Some of the cases reported by these authors had a large defect in their cord, as proven by operation or necropsy. Therefore, spasticity is not of necessity a sign of an incomplete cord lesion in patients seen a few months or longer after their injury. The same authors have contributed a paper to the same journal,⁹ in which, in a study of automatic bladder activity after complete spinal lesions, they give very useful suggestions as to the treatment of the bladder symptoms in spinal cord lesions.

The experiences of the war have shown that spinal concussion is very frequent, mainly because of the extensive use of high explosives. It had already been known, of course, that spinal concussion could occur from the impact of a bullet on part of a vertebra, and that the symptoms of concussion varied from slight ones to those of a complete transverse cord lesion. What we have learned from this war is that such concussion often occurs without external injury of any kind when a high explosive shell bursts in close proximity to the individual. The symptoms, due to small hemorrhages into the spinal cord or to air emboli, may cause secondarily a transverse softening of the cord with a permanent transverse lesion. On the other hand, great improvement, and sometimes even complete recovery, may occur within a few months of the injury. (We have personally seen several soldiers who were invalided back to the United States with supposed complete transverse lesions of the spinal cord from concussion, who began to improve soon after their return, and who have, to a great extent, recovered.)

8. Head and Riddoch: *Brain*, Lond. **40**:264, 1918.

9. Head and Riddoch: *Ibid.* **40**:188, 1918.

Roussy and L'Hermite¹⁰ have given an excellent description of these cases of spinal concussion. These authors have also paid much attention to the symptoms of complete and incomplete spinal lesions. They state that in some cases with apparently the symptoms and signs of a complete transverse cord lesion, careful examination will reveal that some sensation persists in the perineum and over the coccyx. (We have carefully looked for this in a number of patients, but as yet have failed to find it in any cases of so-called complete lesions.)

III. INJURIES OF THE PERIPHERAL NERVES

There never has been before and perhaps there never again will be an occasion like the present for the study of the anatomy and physiology of the peripheral nerves, the symptoms of complete and incomplete nerve lesions, the manner and the course of nerve regeneration, the technic of neurolysis, nerve suture, nerve transplantation, etc., and the results that can be obtained by surgical treatment. The literature of the subject is already very large, and is still growing. The importance of the subject is universally recognized, and careful studies are being made in all countries. The Surgeon-General of our Army has appointed a special commission of neurologists, surgeons and neuropathologists to report on the subject of peripheral nerve injuries. A large amount of useful information has already been collected. It is certain that, as a result of the experiences of the great war, a thorough and profound knowledge of peripheral nerve injuries will have been gained. Already excellent textbooks on wounds of the nerves (Tinel, Athanassio-Benisty, etc.) have been published.

Within the compass of this short review only a few points can be touched on.

A good knowledge of the finer anatomy of the nerves and the exact levels at which sensory and motor branches leave the main trunk is important for the neuro-surgeon and for the neurologist, and the experiences of the war have given us a very large amount of information regarding the normal and the many variations from the normal that may be encountered.¹¹

Much information has also been gathered regarding nerve pattern and the course of fibers in the peripheral nerves. This was a subject to which very little attention had been paid in the past — a subject of

10. Roussy and L'Hermite: *Blessures de la Moelle et de la Queue de Cheval*, Masson et Cie, 1918.

11. Tinel, loc. cit.; Bonisty, loc. cit.; Borchard and Wjasmenski: *Bruns' Beitr.* 107:353, 1917; Verga: *Compt. rend. de la Conférence Chirurgicale inter-alliée*; Burrows, *Brit. M. J.*, p. 1199, 1918. Rauschburg: *Bruns' Beitr.*, 1918; etc.

practical importance for the surgeon.¹² Thus, for example, motor fibers to the pronator radii teres run down on the outer side of the inner head of the median and then along the outer aspect of the main trunk of the nerve, while the fibers to the flexor carpi radialis run down the outer side of the outer head and then run down the trunk of the nerve with the fibers to the pronator teres. The fibers to the flexor sublimis digitorum run down on the posterior and inner aspects of the inner head and the trunk of the median nerve together with the fibers to the flexor profundus digitorum, flexor longus pollicis and pronator quadratus. The sensory fibers occupy the most central portion of the median trunk. The course of sensory and motor fibers has been traced in all of the large nerve trunks, and it is clear that this knowledge is very important for those who have to make indications for operative interference in incomplete nerve injuries.

We cannot enter on the subject of the symptomatology of nerve lesions except to state that we now possess a good knowledge of the typical symptoms of complete and incomplete nerve lesions and of the many variations from the typical pictures that are met with. Careful observations have proved that there is never complete recovery of tactile sensation nor of active motor power for at least three months after the suture of a divided nerve. According to Gosset, the average time before the return of the first voluntary movements is six months for the median, eight months for the musculospiral, ten months for the external and eleven for the internal popliteal, eleven months for the ulnar, and sixteen months for the sciatic nerves. Joyce¹³ has seen improvement within three months and complete recoveries within fifteen months. Several years will have to elapse, however, before very large statistics on end-results will be available. There is not any doubt that the earlier a divided nerve is sutured, the more rapid and the more complete will be the nerve regeneration. The large majority of the wounds in the war were complicated by infection and therefore there was a necessary delay before nerve suture could be performed. It has been the custom of most operators to wait at least three months after a wound that had been infected was completely healed before a nerve suture was undertaken, in order to avoid a possible infection of the newly made wound and nerve suture from a dormant focus.

Careful and repeated neurological examinations must precede every nerve operation, because only by this means is it possible to determine whether the nerve in question is completely or incompletely interrupted and whether any regeneration has occurred. If the interruption is not a complete one, then the surgeon must be conservative in his

12. Stoffel; Marie, Meige et Gosset: *Compt. rend. Acad. de méd.*, Dec. 28, 1915; Déjirine, *Presse méd.*, No. 13, 1916; etc.

13. Joice, J. L.: *Brit. J. Surg.* 6:418 (Jan.) 1919.

surgical methods, or if some regeneration has occurred, conservative surgery is also called for. In this type of case, neurolysis—the freeing of the nerve from compression by scar tissue—and perhaps partial resection of a nerve is all that is required. Neurolysis will often suffice. If the examinations showed that part of the nerve was completely interrupted and had not improved (and to arrive at such a conclusion a knowledge of nerve pattern is indispensable), the operator may find a bulbous thickening of only that part of the nerve. In such a case, resection of the bulb (part of the thickness of the nerve trunk) may be necessary. Experience has shown, however, that the surgeon should always stimulate all sides of the nerve trunk electrically before determining to divide part of a motor or mixed nerve.

The same statement must be made for all nerve resections. As long as the gross continuity of the nerve remains, even if there is a large bulb, this bulb should never be resected before the exposed nerve has been tested with the electric current.

If a nerve bulb is to be resected, the surgeon must remove successive transverse sections of the bulb until distinct funiculi can be seen in the transverse section.

End to end suture should always be accomplished without tension, and can often be successfully done if the extremity is placed in the most favorable position for relaxation of tension. Very fine silk on very fine cambric needles should be used, and the nerve ends should be placed in as near the normal relation to each other (without rotation) as possible. Professor Huber, of Ann Arbor, who has done an enormous amount of experimental and pathologic work on nerve suture and nerve transplantation, states that these fine sutures can be passed through the entire thickness of the nerve trunk.

If, after resection of a bulb, the nerve ends cannot be approximated, or if there is a large defect between the freshened nerve ends, then nerve grafting is called for. All experimenters are agreed that the autograft is the best in animals, but that homografts and even heterografts may succeed in animal operations. The value of nerve grafting in man has yet to be determined by the results that will be obtained. Fresh grafts are preferable, a cutaneous nerve such as the cutaneous branches of the musculo-cutaneous or the internal cutaneous in the upper extremity and the long saphenous in the lower limb should be used. Whether especially good results in the human being would follow the use of grafts preserved in cold storage or in alcohol, has still to be finally determined. The results of the animal experiments justify a trial of these methods.¹⁴

14. Huber, Nageotte: *Compt. rend. Soc. de biol.*, 1918; Duroux et Couvreur: *Lyon chir.*, p. 516, 1917. Dujarier et Francois: *Bull. et mém. de la Soc. de chir. de Par.* 44:43, 1918.

Huber's work, not yet published, is very complete and convincing, and I have been guided in my operations by the results of his experimental work. Lateral implantations and nerve plastics are not only useless, but directly harmful in the large majority of instances. The only proper nerve anastomosis is an end to end approximation, and with our present knowledge this is the only method of nerve suture that will give satisfactory results. Through the large number of peripheral nerve operations that have been and are being done, the finer technical details—into which we shall not go—have been thoroughly worked out, and there are today definite technical principles which must guide the surgeon in his operative work. The final results will not be known until several years have passed.

Abstracts from Current Literature

THE MORPHOLOGY AND EVOLUTIONAL SIGNIFICANCE OF THE PINEAL BODY. Part I. FREDERICK TILNEY, M.D., Ph.D., and LUTHER F. WARREN, A.B., M.D., *The American Anatomical Memoirs*, No. 9, February, 1919. Published by the Wistar Institute of Anatomy and Biology, Philadelphia.

"Son siège au milieu de parties très-importantes de l'encéphale, sa constance chez l'homme et le vertèbrés, font pourtant présumer que ses usages, s'ils ne sont pas d'un ordre aussi important qu'on le supposait à l'époque des Esprits Vitaux, n'en sont pas moins réels et très-intéressant à connaître." This introduction, taken from Legros, to a work of so complete, so critical and so finished a character as this first volume on the pineal body, suggests a suspicion of anti-climax which is, to say the least, not applicable to the volume which follows. The marshalling of the facts that are presented to us by these investigators through the comparative morphology, embryology and anatomy and histology of the pineal body in the various vertebrate types leaves for us no choice but to espouse their conclusion, which is practically forced on us. The morphologic problem has been formulated as follows:

1. What is the significance of the pineal region in its relation to the epiphysis?
2. Is the pineal body a vestige or is it an organ in some way necessary to metabolism?
3. Does its structure furnish evidence of its function?
4. What relation does it bear to the third or parietal eye?
5. What is the phylogenetic significance of the parietal eye with reference to the vertebrates and invertebrates?

Rather more than usual interest attaches to their explosion of the theory that the pineal body is the vestigial remains of the parietal eye. "The theory that the pineal body is the vestige of the parietal eye is accepted by many. According to this view, the third eye of vertebrates should be regarded as primordial and the pineal body an arrested development in the attempt to reach such differentiation. The evidence, however, is by no means conclusive, for, as has previously been shown, the entire epiphyseal complex springs from a region which is fundamentally glandiferous, while only in a very few instances is a tendency toward sensory differentiation recognizable in it. By far the great majority of vertebrates manifest in the epiphyseal complex no tendency whatsoever toward the development of any neural mechanism. This would seem to indicate that the tendency for the epiphyseal complex to develop visual structures is a secondary and not a primordial character. Furthermore, if the pineal body was in any true sense the vestige of the parietal eye, it would seem almost inevitable that the organ should contain remnants indicative of visual specialization. The absence of such evidence at least raises a reasonable doubt that the pineal body had at any time possessed visual function. The almost universal absence of true ganglionic cells as well as the lack of nerve fibers, which may be regarded as belonging to some category other than those of the sympathetic system, would seem to call into question

the possibility of the pineal body ever having participated in the formation of a neural mechanism. This may be considered negative evidence. There remains to be mentioned, however, the significant fact that the pineal body in all of the higher vertebrates manifests a tendency to differentiate along lines which cannot be interpreted as in the interests of visual function. As has been previously shown, the differentiation which does occur in the higher reptiles, birds, and mammals gives rise to glandular tissue. From these facts it seems possible to conclude that the pineal body is not a vestige of the parietal eye."

The answers to their questions are furnished as a conclusion and summary of the exhaustive analysis made by the authors, of the work of other investigators, as well as by their individual research; especially in the fields of comparative anatomy and histology and encephalic architectonic. These conclusions, respectively, to the questions propounded, are:

"I. The pineal region is preponderatingly glandiferous in its derivatives. The morphogenetic impulse imparted by such a gland-forming area could not fail to have a profound influence on one of its constituents, the epiphysis.

II. (a) The pineal body cannot be a vestige from the evidence based on its gross morphology, for the following reasons:

1. The phyletic constancy of the epiphysis in the vertebrate phylum.
2. Its variations and morphologic specializations.
3. Its relatively greater phyletic constancy with reference to other structures in the pineal region.
4. The gross evidence of its progressive specializations in ophidians, birds, and mammals.
5. The increase in the epiphyso-cerebral index, from the earliest stages to the latest periods of life in man.

6. (a) The resistance to the encroachment of a prominent neomorph in the mammalian brain, that is, the corpus callosum, which has produced such marked alterations in the other constituents of the diencephalic roof-plate.

(b) The pineal gland cannot be considered a vestige in the light of the histologic evidence, since the tendency toward specialization is definitely in the interest of glandular formation in ophidians, chelonians, birds, and mammals. The pineal body is, therefore, a glandular structure and as such, is necessary in some way to metabolism.

III. The histology of the organ gives clear evidence that the epiphyseal complex of vertebrates possesses a pluripotentiality whose fundamental inherent tendency is in the interest of glandular differentiation, but in a few instances, as in cyclostomes, amphibia, and in primitive reptiles, the pineal organ may become further differentiated in the interest of a highly specialized sensory mechanism which has, or has had, visual function. As a gland, it may in some cases, contribute its secretion to the cerebrospinal fluid, but in the higher vertebrates, as in ophidians, chelonians, birds, and mammals, it is an endocrinic organ, contributing the products of its secretion to the blood stream.

IV. (a) There is no direct relation between the parietal eye and the pineal body, but each is of itself an adaptive modification answering the demands for, or representing, an inherent impulse toward the development of a parietal eye, on the one hand, or a glandular organ, on the other.

(b) The pineal body as it appears in mammals cannot be regarded as the vestigial or metamorphosed degenerated or atrophic residuum of the parietal eye in vertebrates.

V. The phylogenetic significance of the parietal eye in vertebrates as the homologue of the median eye in invertebrates should be accepted with much reservation. Until such time as the homology between the vertebrate pineal region and some corresponding area of the invertebrate brain is much more firmly established than at present, the parietal eye as an index in the evolution of the vertebrates from the invertebrates has but little value."

It may be an interesting commentary in connection with the above conclusions that one of the authors, at least, approached the problem with a rather marked predilection against the view of the glandiferous character of the pineal body, and was converted to the endocrinous character of the conarium by the investigations herewith published. We look with anticipatory pleasure to the early appearance of the Second and Third Parts, embracing the physiology and pathology, and the clinical aspects of the pineal body. The reception of the work by comparative neurologists and by the endocrinologists should be of a most congratulatory nature to the authors, for it is an added foundation to the theory of the importance of the endocrine structures.

TIMME, New York.

CERTAIN OF THE CLINICAL ASPECTS OF "LATE CATATONIA"
WITH A REPORT OF CASES. EDWARD A. STRECKER, M.D., Am. J.
Insan. 74:184, (Oct.) 1917.

In a study of 117 cases (two years' admissions) of individuals between 40 and 60, Strecker finds twenty-five cases in which catatonic-like symptoms existed. He concludes, however, that there is nothing to justify the assumption of late catatonic "disease process." The essential part of the paper is a study of the catatonic-like symptoms which he differentiates from true catatonic ones. He takes up various factors which may bring these about. He states that stereotypy may be simulated in some depressions in which the depressive affect is at a relatively low plane for a long time. In such cases the association between affect and affect-expression may become more and more indefinite, and when the affect disappears the expression may apparently be perpetuated in a purely automatic manner. A dementing process, "presumably arteriosclerotic," may then produce other catatonic-like symptoms such as spells of scratching, biting, kicking, etc., which are regarded as possibly irritative phenomena. Some refusal of food, resistiveness, etc., Strecker is inclined to attribute to an exaggeration of the "physiological" irritability of the climacterism. These symptoms, according to Strecker, often make the impression of outbursts of temper; they are therefore a reaction to the environment and associated with marked affects, and totally different from the more automatic catatonic manifestations. Confusion may give rise to resistance, struggling, etc., as a result of dangers confusedly seen in acts and occurrences in the environment. Such confused states, Strecker suggests, might be due to metabolism disorders. Somatic and nihilistic delusions are also a source of opposition, refusal of food, etc. As already stated, Strecker is inclined to attribute some influence to arteriosclerotic brain changes. It seems to the reviewer that Strecker is inclined to generalize too much about arteriosclerotic brain disease. He is, for example, inclined to attribute the bad prognosis of involution melancholias to this factor. There is no question

that there are cases with the symptomatology of involution melancholias in which a cerebral arteriosclerosis can be definitely demonstrated either by the characteristic deterioration (mental tension defect) or by focal symptoms. To go beyond this would seem unsafe and, in view of the distracting, absorbing affects, various apparent difficulties of thinking or orientation can often not even be used for this purpose. In general, while the reviewer agrees that there is no such "disease process" as late catatonia and that Strickler's interpretations are in the main acceptable, he feels that twenty-five cases are hardly enough to assume that no true catatonic symptoms occur, for there is after all probably no hard and fast line between, for example, the more automatic catatonic negativism and the opposition more clearly backed up by affects or ideas.

Hoch, Montecito, Calif.

ZUR DIAGNOSTISCHEN BEWERTUNG DER VARIETÄTEN DES
BABINSKI'SCHEN REFLEXES. ROBERT BING, Basel, Schweiz. Arch. f.
Neurol. u. Psychiat. 3:89, 1918.

In a previous article Bing called attention to the fact that very often there occur certain associated movements of special muscle groups when the Babinski phenomenon is elicited. He classified them as follows: (1) Plain Babinski; (2) Babinski plus tonic hyperextension of the other toes or slow spreading (*fanning—signe de l'éventail*); (3) Babinski with simultaneous contraction of the tensor fasciae latae, quadriceps or adductors of the thigh, and (4) Babinski with synchronous "flight or shortening reflex," that is, contraction of the tibialis anticus and flexion of the leg and thigh, lasting several seconds. It is Bing's opinion that significance can be attached to those variations of the Babinski and he takes exception to the view of Sussmann Galant that they are merely expressions of the various responses normally given by different individuals to a similar stimulus. The present article is based on a study of 246 cases showing undoubted spastic symptom complex of pyramidal tract involvement.

Bing noticed a striking difference of reaction in cases with pure cerebral involvement from those of purely spinal origin. In 101 cerebral cases he obtained the Babinski 79 times. Of these only 10 gave simultaneous contraction of the tensor fasciae, adductors or quadriceps, and not once did there occur the shortening reflex. On the other hand, in 46 spinal cases (out of a group of 56) which gave the Babinski he found 6 which showed simultaneous contraction of the thigh muscles and 24 the typical flight reflex, in all 30 cases, or 66 per cent. In cases with both spinal and cerebral involvement (M. S., C-S syphilis, etc.) he found 29.6 per cent. which gave the Babinski with associated contractions. In Bing's opinion the shortening reflex may be said to accompany the Babinski almost in every case in which there is compression of the cord of any kind. Of 28 proved cases only 7 showed exception.

As to the Gordon reflex Bing, in agreement with Auerbach, confirms its author's view that it is elicited more readily in early cases, while the Babinski in late cases, and that in compression of the calf it is a question of deep sensibility. He also noticed that the Gordon was obtained in nine out of ten cases of compression of the cord and that in the tenth case it was a question of syphilitic combined system disease. Knowing as we do that, *cessante causa*, recovery does occur in compression Bing agrees with Gordon and Auerbach that the reflex is elicited in cases with light pyramidal tract lesions.

The contralateral Babinski (or Oppenheim) the author found in six cases, all of which had unilateral cerebral lesions. The crossed reactions in these cases were of two types: (1) Dorsal extension of the big toe of the paretic side on attempt to elicit the phenomenon on the healthy side, and (2) double Babinski on stimulating the paralyzed side. Bing further remarks on the rarity of the Babinski phenomenon in amyotrophic lateral sclerosis. In none of the six cases which he studied did he find it. In six cases of "état lacunaire" of the brain the Babinski was obtained five times, but always only on stimulation of the sole of the foot.

Bing does not draw any conclusions, but merely offers his observations for confirmation by other neurologists.

WECHSLER, New York.

SUR LE RÔLE DE LA DYSTONIE DANS LA DESORGANISATION DES MOUVEMENTS VOLONTAIRES. (LOSS OF TONICITY AND INCOORDINATION OF VOLUNTARY MOVEMENTS.) W. VAN WOERKOM (Rotterdam), *Nouv. Iconog. de la Salpêtrière* 28:37, 1916-1917.

According to the author's observations on a series of cases with anatomic lesions restricted to atrophy of the corpora striata and the region at the base of the optic layers, especially the Luys bodies, these parts may be regarded as exerting a considerable influence on muscular contraction, more particularly on the tonic element contained therein. Healthy individuals are enabled to utilize the regulatory function of the tonic factor in the performance of separate movements, other muscles of the body remaining in a state of tonic equilibrium. In these patients, however, the nervous impulse gives rise to a disturbance of the tonic element which sometimes involves nearly all the muscles of the body. This disturbance of the tonic factor of muscular innervation imparts itself in a great variety of forms. In spite of a very variable external appearance, characterized sometimes by choreiform seizures, in other cases by athetotic movements, or again by spasms and muscular rigidity, the similarity of all these manifestations is indicated especially by the part played by the factor of tonicity in the incoordination of voluntary acts, an entirely different character from that seen in cases with lesions of the posterior roots or the pyramidal tracts.

These patients are sometimes unable to initiate a simple voluntary movement. The concentration of the attention on the muscular movement often acts as an unfavorable element, preventing its accomplishment. Any muscular movement incomplete in itself can be much more readily carried out when it is a part of an habitual innervation complex, or when the attention is diverted. The disturbance exhibited by these patients at the beginning of a simple voluntary act is a very polymorphous and inconstant symptom, manifesting itself especially in the most elementary acts. The affected muscles are not paralyzed, the condition being rather a paresis of some of their functions, that is, a functional paresis instead of a true muscular paralysis. In the ultimate discharge of active movements, the disturbance of the regulatory functions imparts to the voluntary movements either an exaggerated, lively character, or a slow, irregular motion.

Dystonia manifesting itself in the incoordination of active movements often gives rise to innervation complexes approaching in part the picture seen in the classic contractures or in decerebrate rigidity, indicating the significance of the damaged parts for these functions. Lesions of the infracortical

centers, sometimes of the corpora striata alone, may accordingly cause a very peculiar interference with muscular function. The resulting disturbances of active movements present a certain resemblance to the cerebellar syndrome, but the necropsies showed no lesions of the cerebellum, the cerebellar peduncles, the red nucleus, the pyramidal bundles or the bands of Reil. The changes may be restricted to the corpora striata in the subthalamic region, but without involving the red nucleus. The cortex of the frontal lobes is occasionally the seat of evident changes, but in other cases is found to be intact.

GOODHART, New York.

DISTURBANCES OF VISION BY CEREBRAL LESIONS. GORDON HOLMES, C.M.G., M.D., Lieutenant-Colonel, R. A. M. C., Brit. J. Ophthalm. 2:353 (July) 1918.

Holmes first calls attention to certain conclusions regarding the cortical representation of the retina previously reached by himself and Lister. These are:

1. The upper half of each retina is represented in the dorsal, and the lower, in the ventral part of each visual area.
2. The center for macular or central vision lies in the posterior extremities of the visual areas, probably in the margins and the lateral surfaces of the occipital poles. The macular region has not a bilateral representation.
3. The center for vision subserved by the periphery of the retina is probably situated in the anterior ends of the visual areas, and the serial concentric zones of the retina from the macula to the periphery are probably represented in this order from behind forward in the visual cortex.

These conclusions are in conformity with those previously arrived at by Marie and Chatelin.

The author, after the examination of a large number of cases occurring in soldiers, in which there had been defects or disturbances of vision, produced by local cerebral injuries, has made certain observations which are of value not only in confirmation of the contentions already made but also in the elucidation of the probable representation of the different portions of the visual fields in the calcarine cortex.

First, there is taken up the question of local defects in the field of vision. Of these, central and paracentral scotomas are extremely common. Paracentral scotomas, especially in the lower quadrants, due to unilateral occipital injuries are relatively much more common than are central scotomas. In all the cases of unilateral inferior paracentral scotomas examined, the injury involved the tip or posterior portion of one occipital lobe, at or immediately above the level of the calcarine fissure, the size of the scotomas generally standing in close relation to the depth of the wound. Holmes presents three cases of the much less common superior paracentral scotomas. In these the lesion, as far as could be determined from the position of the wound and from roentgenographic examination, involved the lower part of the area striata.

In answer to the question as to why the area of central vision is so commonly affected in traumatic injuries, two explanations may be invoked. One is that the macula is projected on to a part of the visual cortex which is likely to be damaged by all injuries to the occipital cortex. The other is that macular vision, being very highly specialized, has a much more extensive cortical representation than has the peripheral. Both explanations are quite likely correct.

Four cases are presented showing sector scotomas. These cases tend to show, though in the absence of anatomic examination they cannot be regarded as conclusive evidence, that those portions of the retina which lie along the vertical radii are represented on the exposed visual surfaces of the occipital lobes, and by exclusion one might assume that the retina on either side of the horizontal radii is projected onto the visual cortex which occupies the walls of the calcarine fissures. A fact lending additional weight to this hypothesis is the great rarity of cases of sector scotomas for, if the hypothesis is correct it is what might be expected as it would be almost impossible to produce an injury to but a small area on the floor of the calcarine fissure.

Bearing on the cortical representation of peripheral vision and in accordance with a case recently described by Riddoch, is the case of a soldier, the roentgenographic examination of whom showed a piece of shell-casing just to the right of the midline in the position corresponding, in the average normal head, to the calcarine fissure immediately in front of the parieto-occipital fissure. Examination of this patient, on three separate occasions showed a contraction of the temporal periphery of the left visual field down to between 60 and 70 degrees and a slight contraction of the nasal half of the field of the right eye. A considerable number of cases in which quadrantic hemianopias or other regular defects in the fields resulted from lesions of the optic radiations were seen by the author.

In two cases reported, in which direct injury of the calcarine cortex can be excluded, lesions of the lower parts of the optic radiations of one side produced a superior quadrantic hemianopia. These findings together with those of other cases cause the author to admit that it is tempting to assume that in the main mass of the optic radiations the fibers connected indirectly with the upper and lower halves of the retina are contained in distinct bundles separated from each other by an anatomic interval. This hypothesis, however, cannot be accepted without further evidence, it is felt. No case has been observed in which a paracentral scotoma, or an isolated affection of central or pericentral vision, could be attributed to a lesion of the radiations.

Regarding the portion of the field in which recovery first occurs, Holmes takes exception to the statement of Riddoch that "the recovery of the appreciation of movement begins in the periphery of the field and extends inward toward central vision." Both his own cases and those of Hine tend to disprove this.

Many of the transient and recoverable symptoms are attributed to degeneration of the myelinated fibers and especially to edematous swelling. Holmes is also of the opinion, as far as his observations go, that the so-called dissociation of visual perception, due to occipital injuries, recently described by Riddoch, should not be spoken of as a dissociation of the elements of visual sensation, since it is only a condition of visual hypo-esthesia in which only the stronger and more adequate stimuli excite sensations. It is admitted, however, that dissociation of function, with intact retinal sensibility, may be caused by injuries of other parts of the brain. Observations extending over a large number of cases have also tended to show that an isolated loss or dissociation of color vision is not produced by cerebral lesions.

Two unusual affections of vision, occurring in lesions of portions of the brain anterior to the occipital lobes, have been noted. The most frequent of these is an affection of visual attention. In this condition, though there is no diminution of visual sensibility or restriction of the fields, the patient frequently fails to recognize objects brought into the affected homonymous

halves of the fields, though they are perceived at once when introduced into the opposite halves. This condition is usually associated with lesions of the parietal lobe involving the supramarginal gyrus or its neighborhood. In some of the cases with this condition there was noted a similar local tactile attention loss, of the type previously described by Head and the author, on the same side of the body.

The author has seen six additional cases of a form of visual disturbance of the type previously reported by him with Smith, in which there is a loss of visual orientation and appreciation of depth, in which the condition is seemingly dependent on injury of the brain in the neighborhood of the angular and supramarginal gyri.

This valuable and interesting article is summarized in the following conclusions:

1. Those portions of the retinae adjoining their vertical axes are probably represented in the dorsal and ventral margins of the visual areas, while the retina in the neighborhood of its horizontal axis is projected onto the walls and floor of the calcarine fissures.

2. Severe lesions of the visual cortex produce complete blindness in the corresponding portions of the visual fields, or if incomplete an amblyopia, color vision being generally lost and white objects appearing indistinct, or only more potent stimuli, as abruptly moving objects, may excite sensations.

3. The defects of vision in the fields of the two eyes are always congruous and superimposable, providing that no abnormality of the peripheral visual apparatus exists.

4. Lesions of the lateral surfaces of the hemispheres, particularly of the posterior parietal regions, may cause certain disturbances of the higher visual perceptual functions with intact visual sensibility, as loss of visual orientation and localization in space, disturbance of the perception of depth and distance, visual attention loss, and visual agnosia.

STANTON, Ann Arbor, Mich.

THE THEORY OF SYMBOLISM. ERNEST JONES, M.D., *Brit. J. Psychol.* 9:181, (Oct.) 1918.

In this considerable discussion of symbolism Jones has both extended and further specified those notions which emerge from the more strict freudian school as contrasted with the ideas of Jung, Silberer and others whom, with, perhaps, not a well timed animus, he has termed the "postpsycho-analytic school." His own argument runs so well on all fours that there is even less need for this feeling. There can be no doubt that the stimulus afforded by the Zurich school has had an effect within the more strict freudian circle. Yet the extensions in the later departures of Jung contain much sufficiently mystical, religious and ethical to give point to the clear and psychologic criticism effected in this article by Jones. It is this aspect which here will be briefly presented.

His isolation of symbolism, as a fundamental type of indirect representation, from others more or less allied, as metaphor, etc., is preceded by a consideration of symbolism in its broader sense as indicating "a relative incapacity for either apprehension or presentation," affective or intellectual in origin, the former being the more important. This incapacity is not a cause, as Silberer makes it, but an indispensable condition. Because of this inca-

capacity the mind reverts to the simpler type of mental process, with degrees in this regression, relating the more highly developed forms of symbolism to those points where the inhibition of feeling is greatest.

Through this mode of approach by way of the more general symbolism Jones raises the question as to how in relation to the inhibited feeling there may be seen the function of the metaphor in which an adjective or connotation is replaced by a concrete likeness. This method of approach to the subject appears useful in view of our well known resistances. He defines identification as the basic feature of symbolism and related both to the pleasure and reality principle. To the first in the fact that it is more pleasant to read the new by way of the old, for the interest resides here; that is, it is not a question of immature development and failure to comprehend on this basis which drives to symbolism, but a dynamic interest in pleasure which guides to this end. He rightly apprehends the effect of this kind of development along affective and intellectual lines.

Where the affective inhibition is highest, symbolism in its typical form appears, and for this Jones proposes to reserve the term of symbolism, although he recognizes the continuum between this and other forms. He specifies this position, then, as making symbolism that in which the process is unconscious, with the affect investing the symbolized idea and further as being "not capable of that modification in quality termed sublimation," to which latter term he has given also a better meaning by seeing in it an "ontogenetic repetition of the deeper tendency of phylogeny of draining off sexual energy into non-sexual channels." It is hence more biologic and as a concept has less of the conscious moral or ethical which is improperly imputed to it.

The typical attributes of true symbolism are (1) representation of unconscious material; (2) constant meaning; (3) nondependence on individual factors only; (4) an evolutionary basis; (5) linguistic connections between the symbol and the idea symbolized, and (6) phylogenetic parallels. The ideas symbolized "arise as the result of a regression from a higher level of meaning to a more primitive one; the actual and real meaning of an idea is temporarily lost and it is used to represent and carry the meaning of a more primitive idea, with which it was once symbolically equivalent." The notions involved here are important, for the difference of most pragmatic value established by Jones, in opposition to Jung and Silberer, is defined in the notions of progression beyond this early stage of symbolic equivalency. A different attitude taken here yields a totally different orientation as to individual progression, a matter of large moment in the consideration of adaptations and maladaptations. Progress ensues beyond the early stage of "symbolic equivalency" where the symbolic meaning has been transferred from the primary, or unconscious, idea to a secondary idea going along with the modification of the affects belonging to the primary idea, to the end that these affects may become attached to more useful conscious and noninhibited ideas.

There is here a partial renunciation as regards the original complex, with, however, a compensation of it by other ideas. But if the affect of this complex, or primary idea, be not considerably modified, the complex pushes forward, not in its original form, but by means of its early symbolic equivalents, like a secondary idea. This latter, then, carries a significance of the complex and becomes its symbol. Beyond this there can be no progression until there be a further loosening of the bonds between the complex and its substitutive secondary idea, or symbolic equivalent, with the more definite renouncing of the complex as a source of direct gratification. Jones emphasizes in this fact

that by way of the symbolic equivalents progress is made. It is the symbolic equivalent that is the basis of symbolism. "Progress does not take place via the symbolism, but via the symbolic equivalents; the symbolism itself in fact constitutes a barrier to progress. This is best seen in the blind alley of neurotic symptomatology."

Jones sees Silberer's failure as the "confounding of the process of symbolic equivalency with that of symbolism itself." Jung and Silberer have described progress by way of the symbols. The notion of the "future idea," "the higher form of truth," as residing in the symbol is thus denied by Jones, who sees in the continued "symbolic use of the symbol" that function which prevents truly progressive ideas from occurring. It is only by a surrender of the subjective that the higher objective meanings may come about. He expands this by considering progression as seen in other conscious tendencies, as science, there differing from the symbol use "in that with the latter the original unconscious complex is retained unaltered and merely transferred on to a secondary idea, that of the symbol, while with the former the psychical energy alone, not the significance, is derived from the unconscious complexes and is transferred on to another set of ideas that have their own significance."

Silberer's "functional interpretation" of the symbol Jones considers as "the regression proceeding only a certain distance and as mainly concerned with the more conscious reactions to the sublimation of the unconscious complex." Silberer, then, confounds really that which is more like a metaphor in structure with that of true symbolism which represents regression to a deeper level. The difference is one between "over-sublimation in the metaphor and under-sublimation in the symbolism." That is, Silberer, as Jones sees him, locates the meaning of a symbol less in the unconscious complexes and more in the ethical repressions effecting this unconscious and in the sublimated tendencies issuing out of the unconscious dynamics. While the material of the symbol, Jones holds, is derived from these sublimations, the meaning of the symbol is drawn totally from the unconscious; nor can it be located in the repressing factors which in their effect on the unconscious have brought about the sublimations. That the sublimations and repressive factors may be symbolized, Jones grants, but it is here a metaphor; there is used a borrowed symbol for another end. That is, the unconscious is the original giver of meaning to the symbol; if another meaning be given to it it is metaphorical or functional.

The entire essay is worth study for a consideration of the psychologic mechanisms so acutely defined in symbols, in their isolated setting affording a somewhat sharper outline than when presenting in the psychoneurotic and psychotic. It affords also an orientation as to the better reconstructive lines to be pursued and those most aptly coinciding with the evolving modes of the individual. The sharp counterpoising of two apparently opposing points of view enhances the value for the reader.

PARKER, New York.

PARALYSIE GENERALE CHEZ UNE OXYCEPHALIQUE. (GENERAL PARALYSIS IN A PATIENT WITH AN OXYCEPHALIC SKULL.) H. FLOURNOY, *Nouv. Iconog. de la Salpêtrière*, 28:15, 1916-1917.

The author's patient was a woman, aged 34, with a skull marked by oxycephalus—having a sharp peaked crown and a high vertical index. The patient entered the hospital suffering from general paralysis and died about six weeks later as the result of pulmonary embolism.

Aside from all etiologic considerations, oxycephalus is attended by certain sudden manifestations which the author is inclined to attribute to the abnormal curvature of the aqueduct of Sylvius, causing sudden ventricular stasis comparable to the symptoms of some brain tumors. It is possible that oxycephalus may be related to an irregular periodical increase in size of the brain, not involving all parts of the organ at the same time. The optic nerve atrophy seen in these cases is not the result of a narrowness of the bony canal, but is due to an exaggerated intracranial and intraventricular pressure, together with a damming-back of the cerebrospinal fluid which results therefrom. Paralysis of the third cranial nerves is also dependent on the intraventricular pressure; it is a nuclear paralysis, the nucleus being situated under the wall of the third ventricle and the floor of the aqueduct.

One of the most distinct postmortem signs of pressure is the existence of digitated impressions on the internal surface of the skull. The erosion of the bone may reach such a degree as to terminate in spontaneous perforation. The maximum of these digitated impressions corresponds to the slightest thickness of the cerebral cortex and the cranial vault.

GOODHART, New York.

THE TREATMENT OF SECONDARY AND LATE COMPLICATIONS OF BRAIN WOUNDS. *Comptes-Rendus de la Conférence chirurgicale interalliée pour l'étude des plaies de guerre*, 3e session, 5-8, Novembre, 1917. GORDON HOLMES, Editorial Comment, *Ann. Surg.* 69:184 (Feb.) 1919.

Holmes reviews the records of 2,357 patients admitted to the hospitals of the United Kingdom with gunshot wounds of the cranium. Of these, 1,567 dated back far enough to study the secondary complications—from three months to two or three years.

Brain Abscesses.—These developed in thirty-seven cases. The great majority occurred between the third and sixth month. From then on the number of cases rapidly diminished, and only one case occurred after the tenth month. Most frequently they developed around bony sequestra or under necrosed fragments of the cranium. In a small percentage of cases they developed around retained foreign bodies. Abscess is relatively more frequent in wounds involving the orbit or ethmoid region. Of the thirty-seven cases, most of them were operated on, but the operative results were not satisfactory. Twenty-eight cases terminated fatally. The best method of treatment is puncture or evacuation of the abscess by small incision followed by drainage.

Meningitis.—Primary meningitis is the most serious complication and most frequent cause of death in the first period of brain wounds. It is relatively rare in the later course of such wounds, occurring chiefly secondary to abscess.

Encephalitis.—The clinical differentiation between encephalitis and abscess is very difficult. Cases sometimes clear up after the extraction of superficially placed foreign bodies, sometimes after a simple exploratory operation, and sometimes after rest and an ice cap.

Infection of Ventricles.—This occurs most frequently in cases of hernia cerebri with much loss of substance. The ventricle forces its way into the protruding brain tissue and becomes directly infected. Rupture of an abscess into the ventricles leads to the same result. In the former case recovery may occur. The latter is always fatal.

Hernia Cerebri.—This is generally an early complication. But it may persist long, or it may develop late. Of ninety severe cases, seventy recovered.

so that the outlook is not as bad as it at first seemed. The best treatment is the application of aseptic or antiseptic dressings. Surgical treatment properly so-called, is almost uniformly unsuccessful. However, bone splints and fragments of foreign bodies should be removed, and pus collections drained. Operation should be strictly limited to the inflamed parts, and the rest of the brain carefully protected. Contra-lateral decompression sometimes gives good results.

Epilepsy.—Attacks of general or jacksonian epilepsy are very frequent in the earlier period of wounds, but persist in only a small percentage of the cases. Frequently they disappear after the escape of pus or the subsidence of inflammatory foci. It is impossible as yet to estimate the percentage of epilepsy as a later complication of head wounds; but it is less frequent than was formerly believed. Epilepsy occurred in some cases of simple concussion, namely, in the absence of fracture or depression. As to treatment, aside from the removal of a foreign body or the clearing of an abscess, surgical intervention is practically useless. The disease is probably most often due to the presence of cicatricial tissue. In some hospitals it has been the routine to administer bromids to all cases of head wounds, and it would seem that this had lessened the frequency of the complication.

Mental Troubles.—Slight disturbances, such as depression, irritation and forgetfulness are common. Severe mental troubles are rare, and are most frequent following extensive frontal wounds.

Extensive Losses of Cranial Wall.—Aside from the symptoms common to all cranial wounds—headache, vertigo, amnesia, inability to concentrate and insomnia—no special symptoms arise from cranial defects. The principal inconvenience is the danger of injury to the unprotected brain. This can be remedied by protective plate or graft.

Secondary Effects of Retained Splinters.—One hundred and sixty-four cases with retained fragments were examined after from three months up to two or three years. Twenty-three had returned to active service; 129 had been invalided, but of these, thirty-six had taken up some civil occupation; twelve patients died—two following the shock of operation for the removal of the foreign body. Abscess was the most common secondary complication. The average mortality of these cases was 7.3 per cent. as compared with 4.7 per cent. for all cases followed after three months. There is no doubt that in the majority of cases, balls or fragments of shrapnel may remain in the brain without producing accident or symptoms if they are not septic. Considering the danger of attempted removal where the fragments are deeply placed they should be left alone unless showing symptoms of irritation or progressive cranial disease.

SELLING, Portland, Ore.

COMPARATIVE STUDIES ON THE GROWTH OF THE CEREBRAL CORTEX. NAOKI SUGITA, M.D., J. Comp. Neurol. 28:495 (Dec.) 1917; 29:1, 11 (Feb.) 1918; *ibid.* 29:61 (April) 1918; *ibid.* 29:177, 241 (June) 1918.

In the program of the neurological laboratory of the Wistar Institute the problem of the growth of the mammalian nervous system, between birth and maturity, is given the first place.

Some years ago this work was begun by the study of the growth changes in the larger divisions of the nervous system—the brain and spinal cord—and since then this study has been extended to the subdivisions as occasion offered.

Studies of this sort, which deal with size and number, meet at once the technical difficulty arising from the changes in size produced by the reagents employed for the preparation of the material.

Dr. Sugita has overcome this difficulty by determining in every case the amount of change caused by the reagents employed, and by this means has computed correction factors by the aid of which all the measurements can be referred to the fresh specimen. This procedure has not been used before and it therefore makes these studies in a certain sense unique, while at the same time it serves to show the precautions necessary in such determinations—for without these precautions the results would be valueless.

It was Dr. Sugita's aim to determine by measurements how the cerebral cortex grew in the domesticated albino rat; whether its growth in the wild Norway was similar to that in the Albino, and also how far the results for the rat agreed with those for man.

To obtain these facts he has followed, in both the Albino and the gray rat, the changes in the shape of the cerebrum with age (I and III); the increase in the thickness of the cortex (II and IV); the increase in the area and volume of the cortex and in the computed number of nerve cells in it (V, Parts 1 and 2); the growth of the nerve cell bodies (two groups) in the cortex (VI, Parts 1 and 2); the influence of early starvation on cortical growth (VII) and finally, he has made a comparison of his results on the rat with those reported for other mammals (VIII).

From the series of observations on the two forms of the rat and the several comparisons which they permit, a number of general relations appear, as follows:

The longitudinal diameter of the cerebrum tends to become relatively longer during growth (I and III). The thickness of the cortex is greatest at the frontal pole and on the dorsal surface and diminishes gradually, caudad and ventrad. The cortex attains nearly its complete thickness (96 per cent.) at twenty days—the age at which the young rat is weaned. However, at twenty days the brain has only a little more than half its final weight, so that the extension of the cortex to cover the larger cerebrum of the mature brain is accomplished without any significant change in its thickness. At twenty days the computed number of cells in the cortex is complete, but this number is about twice that found at birth, showing that cell multiplication and the migration of cells into the cortex have been active, but have come to an end at the weaning time of the rat.

During the first twenty days of life the enlargement of the cell bodies runs parallel with that of the cortex as a whole. The cell bodies in the pyramidal layer and in the ganglion cell layer do not, however, mature (in size) at the same time, the latter being somewhat in advance of the former, and further, the pyramidal cells after reaching their maximum show clearly a tendency to diminish in size.

When the data for the wild Norway are compared with those for the domesticated Albino they are found to agree in the time relations. Quantitative differences, of course, appear, for we know that at a given age the brain of the wild Norway is both absolutely and relatively heavier than that of the Albino. In accordance with this relation the cortex in the Norway brain is thicker and has a greater volume, and the cells composing it are larger. On the other hand, it is shown that the computed number of the cells in the cortex is the same in both forms—an important result. The number of cells is therefore characteristic for the species.

Moreover, the Albino differs from the Norway by the fact that the eyes in the Albino are imperfect, and vision is poor.

As might be expected, therefore, when a comparison of the thickness of the occipital cortex (visual area) is made, it is found that the cortex in the Albino is especially thin in that region.

When young rats have been starved during the suckling period the effect is to reduce the growth of the cortex by reducing the size of both the cells and fibers, yet the number of the neurons remains unmodified (VII), thus adding to the evidence that each mammalian species probably has in its nervous system a characteristic number of neurons—a number which is constant within the limits of biological variation.

So far as comparisons could be made there appears to be a similarity in the growth of the cortex in the several mammals studied by other investigators, and the scanty data for man show that the phases of growth in the human cortex are similar to those in the rat at the equivalent ages (VIII). The cortex in man therefore has probably attained nearly its complete thickness at the age of 15 months.

DONALDSON, Philadelphia.

Society Transactions

PHILADELPHIA NEUROLOGICAL SOCIETY

Regular Meeting, Feb. 28, 1919

J. HENDRIE LLOYD, M.D., *President*

TWO CASES WITH ATTACKS OF SOMNOLENCE, PROBABLY OF PITUITARY ORIGIN. DR. B. P. WEISS presented these cases.

CASE 1.—History.—The patient is a trainman, aged 41. His chief complaint is periodic somnolence which is uncontrollable. Family history is negative. He denies syphilitic infection. Uses tobacco moderately; no alcohol.

His present illness began about one year ago, when patient would unexpectedly fall asleep. This sleep was profound but would only last a few minutes. Says his head falling on his chest usually awakens him. These periods of somnolence occur only while he is on the train. He has gone from fourteen to sixteen hours without falling asleep once, while at other times he might have from three to twelve attacks during a "run" of fourteen hours.

Physical Examination.—Eyes: Pupils equal, regular, react to light and accommodation. Eye grounds normal. Subcutaneous tissue seems somewhat boggy. There is no cranial nerve involvement. No ataxia of the limbs. There are no tremors and the grip is good. The biceps and triceps reflexes are normal. Gait and station normal. The knee jerks and tendo-Achilles jerks are present and equal on both sides. Ankle-clonus and Babinski reflexes are absent. Sensation is unimpaired. The mental reactions are somewhat sluggish. He is rather slow in answering simple questions. The memory is slightly affected.

Laboratory Reports.—Spinal Fluid: Ten c.c. clear fluid was removed. Pressure not increased but ran freely. Globulin, plus 1; cells, 6; sugar, positive; Wassermann test, negative; blood Wassermann, negative. He was given 200 gm. glucose dissolved in tea. The entire urinary output for the next ten hours was saved; it did not reduce Fehling's nor Nylander's solutions. The urinalysis was negative.

Roentgen-Ray Report.—There is enlargement of the sella turcica with some change in the posterior clinoid processes, probably bony deposits. Plates of sinuses show perfect clearness.

CASE 2.—History.—The second patient is a salesman, aged 27. His chief complaint is somnolence, snoring and nocturnal polyuria. His parents are first cousins. There was no nervous disease in family. He is married and has one healthy child. No miscarriages. Uses no alcohol. Had smoked twenty cigarets daily, but lately has been more moderate. Never had a chancre. Always been fat. Average weight 175 pounds. About a month ago he had the grippe and lost 30 pounds. During this infection, which lasted about two weeks, attacks of somnolence occurred only at very infrequent intervals and were of very short duration.

His present illness started with attacks of somnolence while at work. This has increased so that now he goes to sleep sitting and even while standing. Sleeps continuously from twenty-four to thirty-six hours if undisturbed. He cannot control the attacks, even if in the midst of noise, or while listening to a band the sleeping state will occur. At times while asleep respiration stops for a minute or two, then it becomes rapid and irregular, accompanied by considerable respiratory difficulty, and choking attacks. From the description given by his wife, respiration during sleep resembles the Cheyne-Stokes' type. Polyuria is nocturnal only. Sometimes he passes 3,000 c.c. during a night, even while on a diet with four glasses fluid per day.

Physical Examination.—An obese, short, young, adult male, rather sallow. Hands and feet small, fingers tapering, skin dry. Subcutaneous tissue appears to have a mucoid consistency. Eyes: Pupils react normally. No muscle imbalance. Eye-ground examination reveals nothing of moment. Thyroid palpable. Station and gait normal. No alteration in the knee or ankle jerks. Ankle clonus and Babinski sign are absent. Sensation is unimpaired.

Laboratory Reports.—Blood Wassermann: negative. Spinal fluid examination shows no pathologic change. Urinalysis was negative. Sugar tolerance: when given 200 grains of glucose, no sugar was eliminated in urine.

Roentgen-Ray Report.—Sella turcica is comparatively small. No other evidence of lesion.

DISCUSSION

DR. FRANCIS X. DERCUM said that these cases were of some clinical importance, that they were met with every once in a while and frequently were not recognized. They represented internal secretion disease. In some of these cases Dr. Dercum has gotten good results from thyroid administration. His impression was that the smaller of the two men—the one with pointing of the fingers and the retardation of growth suggesting pituitary deficiency—also suffered from sexual weakness. This man improved for a time on a combined thyroid and pituitary treatment.

DR. B. P. WEISS stated that there were a number of inquiries concerning the sexual apparatus. The second patient presented some deficiency in the sexual apparatus, but his function was unimpaired. He was married, his wife had had one child and no miscarriages. The taller man had no alteration in his sexual make-up and his function was unaltered.

TRAUMATIC BRACHIAL PLEXUS PALSY, OPERATION—MARKED IMPROVEMENT. Second presentation of this case by Dr. F. X. DERCUM.

History.—L. H., aged 24, had been shown at the October meeting of the Society. At that time he presented a severe palsy of the right upper extremity. He had the following history: On April 19, 1918, while standing at the Dupont Powder Works near a press loaded with 60 pounds of gun cotton, the latter suddenly exploded. He was thrown into the air and fell on his back on a table some 10 or 12 feet away. He was unconscious for a few minutes and, when he came to, found himself lying on his back with his right arm under him. He was able to raise himself and to walk a distance of about 150 feet and was then removed to the hospital of the Dupont Works in an automobile. At the hospital he was examined by Dr. Stocks. It was found that the right

arm was paralyzed from the shoulder down; there were also a fracture of the metacarpal bone of the right thumb and several burns, bruises and abrasions over the left arm and wrist. The patient states that the right arm was not only entirely helpless, but also without feeling; he had no pain in the right arm or shoulder, but there was considerable pain in the left arm.

Examination.—On May 4, 1918, when first examined by Dr. Dercum the right upper extremity presented a flaccid palsy, with loss of reflexes, involving the hand, the forearm, the upper arm and the deltoid. The patient could shrug the shoulder, but no movements whatever of the arm itself could be performed. No pain or tenderness could be elicited over the brachial plexus or over any of the nerve trunks. Sensation was entirely lost over the hand and forearm; on the upper arm it was slightly preserved to all forms on all aspects; on the inner aspect of the arm it was slightly better preserved than elsewhere and extended for a short distance below the elbow on the forearm. On the anterior, outer and posterior aspects, sensation though diminished was preserved as far as the junction of the upper and middle thirds of the arm.

On June 25, he was admitted to the Jefferson Hospital. Marked wasting of the muscles of the hand and forearm and to a slightly less pronounced extent in the muscles of the upper arm and shoulder had been established. An electrical examination now revealed faradic and galvanic extinction in the muscles of the hand, forearm and upper arm. The deltoid responded equally to KCl. and AnCl. There had been no changes in the areas of sensory loss. In the outer aspects of the upper arm it was somewhat fainter than at previous examinations. A roentgen-ray examination proved negative. A few days later (July 1) the brachial plexus was freely exposed by Dr. J. Chalmers Da Costa. It was found that the plexus was firmly embedded in scar tissue and its various cords were separated with considerable difficulty. No gross loss or break of continuity was observed. It seemed probable that the plexus had been the seat of a severe contusion with possibly marked extravasation of blood.

Clinical Course.—Little or no change was noted in the condition of the arm for a long time. It was, however, faithfully rubbed, well supported and not allowed to drag at the shoulder. At the first presentation of the case in October, little change was noted; save that Dr. Dercum thought there was a faint return of power in the deltoid and also that there had been some improvement in the sensation of the upper arm. It seemed to descend to a slightly lower level. Several members who were present were not inclined to concede either the action of the deltoid or the presence of sensation on the outer aspect of the arm. The presence of sensation on the inner aspect was clearly due to the intercosto-humeral nerve.

During the winter, the arm has been steadily treated by massage and electricity. At present (Feb. 28, 1919) a remarkable degree of improvement is evident. The arm can now be extended in a horizontal line at the shoulder. There is a feeble—a beginning—return of flexion and extension at the elbow. There is undoubted action of the biceps and triceps. There is a feeble movement of pronation due to the action of the biceps. There is no movement at the wrist or in the hand. Sensation is preserved for touch and pain throughout the upper arm except for a small area on the outer and lower surface of the arm. Sensation is lost below the elbow except for a small area posteriorly and internally just below the elbow.

The power to elevate the arm is no doubt reinforced by the synergic action of shoulder muscles other than the deltoid, but the return of power in the

deltoid though not great, Dr. Dercum thought, must be conceded. The prognosis was at first most discouraging as it seemed not improbable that the plexus had been most extensively injured, perhaps even torn from its roots. The very marked improvement, however, justifies the hope that it has not yet obtained its maximum but will continue.

DISCUSSION

DR. T. TURNER THOMAS said that he had looked particularly for relaxation of the shoulder joint. He did not find it. He looked again particularly for ankylosis of the shoulder joint, or limitation of movement, and he found that the patient had power to raise his arm as far as the joint movement permitted it to go. Dr. Thomas had observed about ten years ago that some of these cases of what were thought to be traumatic brachial paralysis disappeared with the return of normal function of the shoulder joint, excepting when there was a relaxation of the shoulder joint and in every one of those instances in which he operated to restore the shoulder joint to its normal firmness and relations power returned. He came to the conclusion that in the cases that he saw there was not an actual rupture or injury of the brachial plexus, but that probably as the result of the injury to the shoulder joint in most cases there was an extravasation of blood, perhaps synovial fluid, around the nerves adjacent to the injured shoulder joint extending upward to the plexus. He had never been able to prove that by exposure of the plexus, because he believed such operations were not necessary, the extravasation disappearing by absorption. Dr. Thomas stated that Dr. Dercum's patient represented a very severe case. He could not recall one in his experience in which the hand had been so helpless. He had read Madame Klumpke's paper carefully and he had come to the conclusion that the adult cases which she reported were not of this type at all, that they were really brachial plexus ruptures. They were cases in which there was generally a complete loss of power and of sensation, usually below the elbow. In none of his cases was there such a complete loss of power and sensation. Rarely was there much loss of sensation. In some there was almost complete loss of power throughout the whole extremity. In most of them the power in the hand remained and was better than in any other part of the limb. Dr. Thomas' interest in this case was largely in the fact that operation failed to show actual rupture of the plexus. Operations have been done on obstetrical brachial palsies and reports have varied a great deal. He said he had not been willing to accept the findings of ruptured nerves because they had been findings in dense cicatricial tissue and he thought that dissecting nerves out of dense cicatricial tissue did not allow one to make very accurate observation, but in most of the cases no ruptures of the nerves were found, and he thought at the present time that operation on the plexus in obstetrical palsies had nearly gone out of vogue.

DR. WILLIAM G. SPILLER said that the recovery of power in the brachial plexus when the loss had been so intense was interesting, and yet he felt that the man illustrated in addition to recovery of power what is sometimes seen in long-standing partial palsy, a compensatory action of other muscles replacing in some degree the imperfect function of the weak muscles. The man threw his shoulder backward before he attempted to raise the upper limb, and in this way secured a better position for the action of the supraspinatus and possibly of the trapezius. The case taught that the most desperate palsy may not be hopeless. He had seen this illustrated recently by an intense

ulnar nerve palsy. The paralysis had developed as a result of tying the upper limbs to the bed during a delirium. The palsy and atrophy could not have been more intense, and yet after a few months of electrical and other treatment the hand had almost entirely recovered.

Dr. FRANCIS X. DERCUM, in closing, said that when he first saw the case he thought of Dr. Thomas' operation. He did not find that the capsule was relaxed. The signs of an actual nerve palsy were pronounced. On exposure of the brachial plexus it was found matted together by dense cicatricial tissue. Dr. Dercum had not expected the improvement which had followed. He thought that the deltoid contraction could be felt under the finger.

ENCEPHALITIS SIMULATING BRAIN TUMOR. Presented by Dr. D. E. SMITH.

History.—E. S., aged 16 years, was admitted to the University Hospital, Jan. 15, 1919, to the service of Dr. Spiller. He was entirely well until Nov. 1, 1918. At this time he began to have a heavy, dull feeling located in the frontal region, followed by a rather severe headache. This condition lasted about thirty days and was always intensified by any work, and became gradually more intense until about November 20 and then subsided. During most of this time there was nausea, with frequent projectile vomiting. He vomited whether he took food or not. He was not unconscious and had no convulsions. A period of improvement followed from Dec. 1, 1918, to Jan. 8, 1919, there being an occasional attack of headache and vomiting, but of less severity. On Jan. 8, 1919, he was seized with intense headache, drowsiness, nausea and vomiting and was unable to obtain relief. Sleeplessness was caused by the pain. His eyes ached intensely. He occasionally saw objects double. He may have had influenza before the first attack, but this was uncertain. The laboratory findings for syphilis were negative.

Physical Examination.—This was entirely negative except the following: Jan. 17, 1919: vision, O. D., 6/7.5; O. S., 6/15. The pupils were equal and normal. The left superior oblique muscle showed paresis. The media were clear; the disks were very hyperemic, the margins obscured, and the disks were moderately swollen. The retinal veins were dark and tortuous. O. D. disk level was +3 D., fundus +1.5 D. O. S. level was +2 D., fundus +1 D. Diplopia was found over the entire field. Lower fields full; some contraction concentrically of the color fields (Dr. Langdon). Dr. Grayson found complete anesthesia of the soft palate, and the soft palate was also paretic. The anesthesia extended on the left side of the pharynx to about the median line. On February 27 the palatal muscles were still sluggish, but distinctly less paretic. The sensibility also was increased on the left side of the palate and pharynx, though much less so than on the right side. On February 28 no diplopia and no muscular paresis were reported. There had been no fever of any moment, the highest being 100.4 F. once; at times it was subnormal. The pulse was full and regular, no bradycardia.

The ocular findings were important and were obtained at short intervals. The ocular condition became gradually worse and on February 13 vision of the right eye was 6/9, of the left eye 6/15. The right disk was +5½ D., the left +5 D. Lumbar puncture reduced the swelling promptly about 1 diopter, and as frequent examinations showed the swelling of the disks was

subsiding decompression was not done. On February 28 vision of O. D. was 6/6, of O. S. 6/12. The right disk was $+3\frac{1}{2}$ D., the left $+2\frac{1}{2}$ D.*

DISCUSSION

DR. WILLIAM G. SPILLER said that this boy when he first came under his care presented symptoms which were strongly suggestive of intracranial tumor. It was difficult to explain by a diagnosis of tumor the paralysis of the left superior oblique muscle and the paresis and loss of sensation of the soft palate and loss of sensation of the left side of the pharynx. While it is true that many axis cylinders pass through a glioma and that the symptoms of such a tumor are much less intense than the size of the tumor would indicate, it seemed improbable that a glioma could be extensive enough to cause the disturbances of function mentioned without other symptoms. A lumbar puncture done on January 19 had given 3 or 4 cells to the cm., and the Wassermann and globulin reactions were negative.

The diagnosis of a diffuse process was made, and encephalitis was considered. The boy had had a little fever. Serous meningitis was a possible diagnosis. Dr. Spiller had had lumbar puncture done to see the effect on the swelling of the optic disks, and the puncture had caused a rapid diminution in the height of the swelling. He had postponed a cerebral decompression, as repeated observations showed that the condition, including that of the eyes, was improving. The boy is now well.

DR. FRANCIS X. DERCUM asked how long-standing were the symptoms before the boy came under observation.

Dr. Smith replied about two and a half months. Dr. Dercum thought that a possible explanation was offered by serous meningitis.

DR. ALFRED GORDON said the case was an exceedingly interesting one from the standpoint of diagnosis. He recalled another case in which the patient complained of severe headache and had projectile vomiting. The vomiting was so severe that she could not sleep and the patient had distinct asynergia; the knee-jerks were markedly diminished. Everything pointed to possible cerebellar involvement. The Wassermann examination was negative. After the removal of about 20 c.c. of the spinal fluid the patient began to improve and made a complete recovery.

BRAIN TUMOR WITH EXACT ROENTGEN RAY LOCALIZATION.

Presented by DR. J. HENDRIE LLOYD.

History.—The case was interesting because the roentgen ray was particularly accurate in locating the lesion. The patient was a man, aged 34, with a history of venereal infection, who was admitted to hospital with severe frontal headache, vomiting and dizziness. The vomiting was quite characteristically cerebral in type, that is, projectile, frequently repeated, without nausea, and without reference to food in the stomach. The giddiness was shown by a staggering gait to the left. The patient had lost one eye from accident, but the fundus of the other eye was reported normal. Unfortunately the form field was not taken, partly because the patient's mental state made

* On March 10 the vision of O. D. was 6/5, of O. S. 6/9. The disk in each eye was level with the fundus.

cooperation difficult. The Wassermann test of the blood was positive, but for the spinal fluid it was reported negative, although there was a cell count of 40.

Diagnosis and Treatment.—A diagnosis was made of cerebral syphilis, with possible gumma in the right hemisphere, as indicated by a very slight left hemiplegia and astereognosis. This diagnosis was further indicated by the roentgen ray, the report being that there was a dense circumscribed shadow in the posterior cerebral region on the right side, very suggestive of a new growth, probably gumma. The localization indicated by the shadow was the parieto-occipital region. The patient was put on specific treatment, mercurial inunctions and the iodids. He did not do well. The headache and vomiting persisted, and a stuporous state came on. A decompressive operation was then done by Dr. A. C. Wood over the parieto-occipital region, as indicated by the roentgen-ray. The cortex was found bulging and rather soft, but the man's condition on the table was bad, and nothing was accomplished except decompression. The patient died on the following day.

Necropsy Report.—The brain shows a gummatous infiltrating meningitis about the tip of the temporal lobe, extending backward. In the interior of the parieto-occipital region is a new formation, which under the microscope is seen to be characterized by a very free lymphocyte infiltration.

DISCUSSION

DR. CHARLES K. MILLS said in this case which he saw with Dr. Lloyd he had made the diagnosis of a parieto-occipital lesion, probably a tumor. The man had a doubtful hemianopsia, some impairment of muscular sense and also possibly cutaneous sensibility. The patient's mental state was such that Dr. Mills could not get out all the points that he desired. The necropsy seems to have confirmed the diagnosis, except that there was more present than Dr. Mills had supposed.

THE CENTRAL NERVOUS SYSTEM IN PURPURA, HEMORRHAGICA. Presented by DR. ALFRED GORDON.

No record appears to be in the literature concerning the intimate histologic state of the nervous tissue in cases of purpura hemorrhagica. In the case described by Dr. Gordon there was no hemorrhage on the surface of the brain or in the cerebral cavities which is found in hemophilic cases, but profound changes were seen in the tissue of the brain and spinal cord and everywhere confined exclusively to the gray matter. The patient was a child, 5 years of age. His brain and spinal cord on gross appearance were extremely pale. The tissue was very soft and appeared flattened. Nowhere could be seen a single vessel showing the presence of blood in it. Large sections of the brain revealed the same unusual pallor over the entire sectioned surfaces. The cerebral cortex histologically shows diffuse vacuolation. A very large number of cells are destroyed. Empty round spaces filled or not with blood clots or with round cells are seen over extensive areas. In some places empty spaces of the shape of blood vessels, on one side of which a row of round cells is seen. This condition was found over the entire cortex, but much more pronounced in the motor area than in any other portion. The occipital lobe was the least affected. No vacuolation was

observed in the layers of the cerebellar cortex. Basal ganglia, mid-brain, and medulla presented a similar appearance. The condition was totally absent in the white substance of the brain. In the spinal cord the pathologic state was precisely the same. The empty spaces, vacuolation, and destruction of cells were all confined to the cornea, more in the anterior than in the posterior ones.

Dr. Gordon then calls attention to contrast with anemias, in which destruction and degeneration are confined exclusively to the white substance. The involvement of the gray substance in purpura hemorrhagica could perhaps be explained by its more abundant blood supply than that of the white matter, also by the fact that the central branches are of a terminal variety, so that the destruction of tissue is rapid and there is no tendency for repair.

SPECIAL COMMUNICATION. Presented by Dr. WILLIAM G. SPILLER.

Dr. Spiller spoke of a condition he had observed recently in *epidemic cerebrospinal meningitis*. The palpebral fissures were considerably enlarged, the pupils also probably were dilated. Dr. Spiller regarded this as a sign of irritation of the cervical sympathetic by the meningitis. The appearance of wild staring eyes presented by the patient was remarkable. Dr. Spiller referred to four cases which he believed were examples of *transverse myelitis caused by influenza*. In three the diagnosis seemed certain, and in one it was very probable. Two patients showed considerable improvement after a time. One patient died and the fourth doubtless also will die, as his condition is exceedingly grave.

CHICAGO NEUROLOGICAL SOCIETY

Regular Monthly Meeting, Feb. 20, 1919

HUGH T. PATRICK, M.D., *President*

SO-CALLED LETHARGIC ENCEPHALITIS was discussed by Dr. PETER BASSOE.

He stated that during the past few weeks he had been very much impressed with the fact that there was in Chicago an unusual number of cases of encephalitis which followed in the wake of the influenza epidemic. Looking back through the history this was found to have occurred before. In 1745, there was an epidemic in Germany where it was noted that there were many cases of somnolence. This observation was repeated off and on and in the large epidemic of 1889 and 1890 there was a large number of cases of nervous complications, among them a good many cases which were designated as "nona"—a mysterious disease which did not seem to be anything very tangible but was described in medical journals. One Austrian writer maintained that it was an encephalitis chiefly located in the midbrain.

One of the most complete papers of that time on the nervous sequelae of influenza was written by Dr. Archibald Church in 1891. It spoke of multiple neuritis, poliomyelitis, encephalitis, and so on, but the term "nona" did not seem to have reached over here.

Nothing more was heard of "nona," but in 1917 and 1918, after the influenza epidemic, there appeared what in Austria first was called "lethargic encephalitis." An epidemic also appeared in England which first was thought to be due to food poison and then to be a peculiar poliomyelitis but this idea was discarded because there were no cases of ordinary poliomyelitis, and the affection was looked on as a new disease.

In France Sainton claimed it was a cerebral form of influenza, and both he and Wilson in England recalled the old "nona" and realized it was the same malady. The disease has been best described by S. A. K. Wilson in England and Sainton in France, and their descriptions are very similar. The symptoms were somnolence, fever, ocular paralysis, not much headache, and very few meningeal symptoms. There have been some necropsies and a simple encephalitis of the pons and midbrain was found.

Within the last few weeks there had been a number of such cases in Chicago. He referred briefly to those he had seen, asked if the other members of the Society had seen similar ones, and requested them to look out for them.

CASE 1.—A girl, aged 10, on Dec. 27, 1918, showed palsy of the right external rectus. Two weeks later she developed spastic paralysis of the left arm, slight spastic weakness of the left leg. On February 1, difficulty in speech and swallowing set in. She was admitted to the hospital on February 3 and remained in an almost stationary condition for over a week. There was weakness of the facial muscles on both sides. Ankle clonus and the Babinski sign were present on the left side. On February 15, respiratory difficulty suddenly appeared and the patient died. No necropsy. Spinal fluid obtained on February 5 gave a cell count of 4, weakly positive Nonne test and negative Wassermann reaction. The Lange test was quite strong (2343321100).

CASE 2.—A woman, aged 34, about January 20, gradually became listless and drowsy. When examined on February 10 she was disoriented and confused. The temperature was normal, but the pulse was rapid. There was right facial palsy, and protrusion of the tongue was very weak. The tendon reflexes in the left leg were relatively increased. During the next few days the temperature rose and reached 105.6 F. before death from respiratory failure on February 13. At the necropsy no gross brain changes were found aside from congestion which was present in all viscera. Sections from the lenticular nucleus, pons and medulla, show numerous and large perivascular collections of mononuclear cells. The condition was most marked in the upper part of the pons, where hemorrhagic areas also were seen.

CASE 3.—A woman, aged 44, gradually became listless, drowsy and unsteady from about February 1. In walking the right foot was dragged. When seen on February 15, she had a mask-like facial expression and the eyes were half closed. She was conscious, but answered questions in monosyllables only. The facial muscles were weak on both sides, more so on the left. Both arms and legs were moderately rigid, more so on the right side, but the reflexes were practically normal. The spinal fluid was under normal pressure, gave a negative Wassermann test, very weak Nonne and Lange tests, and a cell count of 9. [The patient's condition remained unchanged for a time, then the extremities gradually grew more rigid and there was coarse jerking on attempted movement. Retention of urine set in on February 21. On February 23, while being fed with a spoon, she suddenly choked, developed signs of pulmonary edema and died in two hours. At the necropsy no gross

changes were found in the brain, but histologic examination revealed changes similar in nature and location to those mentioned in the previous case.]

CASE 4.—A girl, aged 13, on February 4, complained of buzzing in the ears. The eyes and throat then became red and on February 10, when the temperature rose to 102 F., she was suspected of having influenza. She became drowsy and had no headache. On February 11 the leukocyte count was 12,200. When seen on February 14, she showed signs of bilateral facial weakness and suggestion of a left Babinski sign. The deep reflexes were increased, more on the left side. She was removed to the hospital and has remained in an extremely lethargic condition. Since February 10 she had been entirely tube fed. The temperature had usually been about 101 F., and the extremities and neck had become very rigid. Repeated cultures of the blood and spinal fluid were negative. Nystagmus had been constant.

[When last seen, on March 12, the condition was practically unchanged.]

CASE 5.—A man, aged 44, was taken with diplopia on February 9. This lasted three days. On February 13 he complained of weakness in the left hand and the temperature reached 103 F. On February 18, retention of urine, weakness and stiffness of the jaw and stiffness of the neck appeared, together with marked listlessness and somnolence. He was admitted to the hospital on February 20. [The condition gradually grew worse, with increasing rigidity of all the muscles of the body. A coarse tremor developed whenever voluntary movement was attempted. The patient never could protrude the tongue beyond the lips, but speech and swallowing remained fairly good. The temperature gradually rose, but the patient remained conscious until a few hours before death on March 8. No organisms were obtained in cultures from blood and spinal fluid; the latter showed increase in cells and globulin. No necropsy.]

The speaker called attention to the preponderatingly extrapyramidal character of the motor disturbance in these cases, the condition of the muscles and the facial expression bearing considerable resemblance to that of paralysis agitans. This condition was ascribed to lesions in the basal ganglia. These cases will be reported in greater detail in the near future.

DISCUSSION

DR. SIDNEY D. WILGUS said he had seen a similar case a short time before. His patient was a man who suffered with influenza about December 1, but this passed off uneventfully in a few days. Then followed several weeks of lassitude. Early in January he began to sleep a great deal, and about this time he noticed that he saw double. The diplopia lasted not more than a week and then disappeared, and has failed to recur. When seen by the family physician at this time his pulse was about 50 and he felt rather weak, but complained of little else except neuralgic pains in the occipital region. Some ten days after the diplopia disappeared he was suddenly stricken with a right facial paralysis. At the same time his tongue was protruded distinctly to the left. There were disturbances of taste. His temperature by this time had been running from 99 to 102 F., and perhaps averaged 101 in the afternoon. There was a distinct Gordon reflex on the left, but there were no other abnormalities of the reflexes. Later this patient developed double facial palsy and quite marked difficulty in swallowing. He appears to be a very sick man. This case had not been thought of in connection with influenza, but had been watched with a good deal of interest; in view of the discussion by Dr. Bassoe, it can be placed quite clearly under the heading of influenzal encephalitis.

DR. L. HARRISON METTLER asked if these cases were always preceded by the ordinary type of bronchial influenza.

DR. BASSOE replied that this was not always the case, but the cases occurred in localities where influenza had been prevalent.

DR. BAYARD HOLMES said he saw a somewhat similar case a few days before, but the patient did not have the eye symptoms and was not drowsy. He thought it was a case of paralysis.

DR. HUGH T. PATRICK stated that he had seen one case of the basal ganglia type and one other that might have belonged to this group, but he had been inclined to think it a case of poliomyelitis of the cerebral type.

HISTOPATHOLOGY OF CARCINOMA OF THE CEREBRAL MEMBRANES. Presented by DR. GEORGE B. HASSIN.

Dr. Hassin read a paper with this title and demonstrated the specimens. (Printed in full in this issue.)

DISCUSSION

DR. PETER BASSOE asked if there was any involvement of the skull and if the skull cap had been examined, as it was common for carcinoma of the breast to have bone metastases.

It reminded him of a case of endothelioma of the dura in which there was a crater-shaped depression of the dura in the occipital region. The tumor spread on the dura in all directions and had grown into and completely filled the superior longitudinal sinus. It had also grown to and almost filled the occipital lobe. Into this crater-shaped depression there fitted a thick button of bone, which, when decalcified, was found infiltrated with tumor.

Dr. Bassoe thought he had once shown the society metastatic carcinoma of the brain from a breast case. Two thirds of the right hemisphere was involved by the carcinoma. There were no pressure symptoms, but very *profound* aphasia and almost complete loss of mind. The brain tissue was replaced by carcinoma without any material increase in volume.

CASE WITH SYMPTOMS OF DERCUM'S DISEASE AND HYSTERICAL MANIFESTATIONS. Presented by DR. SAMUEL N. CLARK.

Abstract.—The symptoms of Dercum's disease in the case reported were as follows: General adiposity, as indicated by a weight of 188 pounds in a woman 4½ feet in height; lipomata, about 120 in number ranging in size from that of a hazelnut to a chestnut distributed subcutaneously on arms, forearms, buttocks and thighs, accompanied by an itching sensation, but practically without pain. At 33 years of age, following an illness, presumably pleurisy, the patient had frequent spells of coughing, apparently voluntary in character, followed by expectoration of bright red blood in amounts described as about as much as a teacupful. Examination of the chest and of the sputum showed no evidence of disease. Finally, the situation became so "deplorable" that the pleural cavity was exposed. No abnormal condition was found. At about 38 years, coincidentally with the disappearance of hysterical manifesta-

tions, the hemorrhages ceased. It is believed that the tendency to hemorrhages, which is a feature of Dercum's disease, coupled with a hysterical type of reaction, gave rise to the hemoptysis.

At 33 years, following the death of a lover, the patient developed fixed phantasies of marriage and motherhood with occasional tantrums, hysterical paralyses and other hysterical conversions. Commitment was precipitated at 37 by alleged attempt at suicide. The phantasies and hysterical conversions disappeared during the year and a half following commitment. A parallel is drawn between the phantasies and an alleged acute illness during which it was demonstrated that the patient caused the thermometer to register falsely. Here, as in the case of the phantasies, the obstacles to the end desired were swept aside by repression and pretense. Following the exposé of the thermometer incident, all complaints referring to the illness ceased abruptly because they were rendered untenable by the fact that the pretense of fever was clearly exposed. The phantasies, tantrums, etc., likewise became untenable in the face of a combination of factors, among which may be mentioned an apparent lack of attention of the physician to the hysterical manifestations, definite proof furnished that certain beliefs could not be true and the knowledge that one in whom she gradually had been educated to have confidence did not share her belief in the phantasies. This view lays stress on the type of reaction rather than on repressed complexes in the genesis of the phantasies. The significance of the view in relation to psychotherapy is manifest.

RECOVERY IN PARANOIA. Presented by DR. RICHARD DEWEY.

Dr. Dewey read a paper on this subject.

Book Reviews

A REVIEW OF NERVE INJURIES AND THEIR TREATMENT. SIR JAMES PURVES STEWART, K.C.M.G., C.B., M.D. (EDIN.), F.R.C.P., and ARTHUR EVANS, M.S., M.D. (LOND.), F.R.C.S. Second Edition. Oxford University Press, London, 1919.

This is the second edition largely rewritten and revised by the authors, both of whom have had large war experience. This war, neurologically speaking, has furnished exceptional experience in injuries of the peripheral nerves and in the neuroses. There have been a number of books on peripheral nerves. There is no one book, however, which gives as much information and presents the subject as well as this small volume, for it not only gives in a brief and succinct manner the neurological and surgical aspects of the subject, but it also gives to the beginner an adequate presentation, so that for example, a ward surgeon or a young neurologist can get out of this volume all the information that he needs to enable him to examine, chart and digest injuries of the peripheral nerves.

The authors still adhere to the idea that regeneration takes place both from the peripheral, as well as the central end of a nerve. They accept and apparently their own experience confirms the sensory views of Head. This question has not been definitely solved. There is a great deal of work in this field being done by American physicians in the various army hospitals, designated for this purpose. Fortunately a peripheral nerve commission has been appointed by the Surgeon-General and no doubt when this work is completed and published, it will be a credit to the American profession, as well as to the Surgeon-General's Office.

The authors' definition of reflex paralysis is interesting. To quote from them: "This condition (originally described by Babinski and Froment) appears to be due to a functional (but not psychogenic) hyperexcitability of the anterior cornual cells in the corresponding segment of the spinal cord, in cases where the reflex paralysis is of a spastic type; or a functional (but not psychogenic) inhibition of hypothermia and cyanosis are doubtless due to disorder of the adjacent nucleus sympathicus in the anterolateral cornu of the cord, which controls the blood vessels of the limb." There are very few examples of this condition in the American Army and it is the opinion of most neurologists who have seen these patients, that they are functional in character, disagreeing in their view from those held by the authors, and by Babinski and Froment.

The authors give statistics of 520 cases of nerve injuries. There is nothing unusual in the distribution of the nerves injured, they being much like those furnished by other authors, with the exception that in the upper limbs, the ulnar nerve was injured more than the musculospiral. There is an unusual number of median nerve cases—forty-four. The illustrations are first rate. The discussion of the surgical treatment is quite up-to-date.

1420 58

